

JUNE

Reg. U.S. Pat. Off.

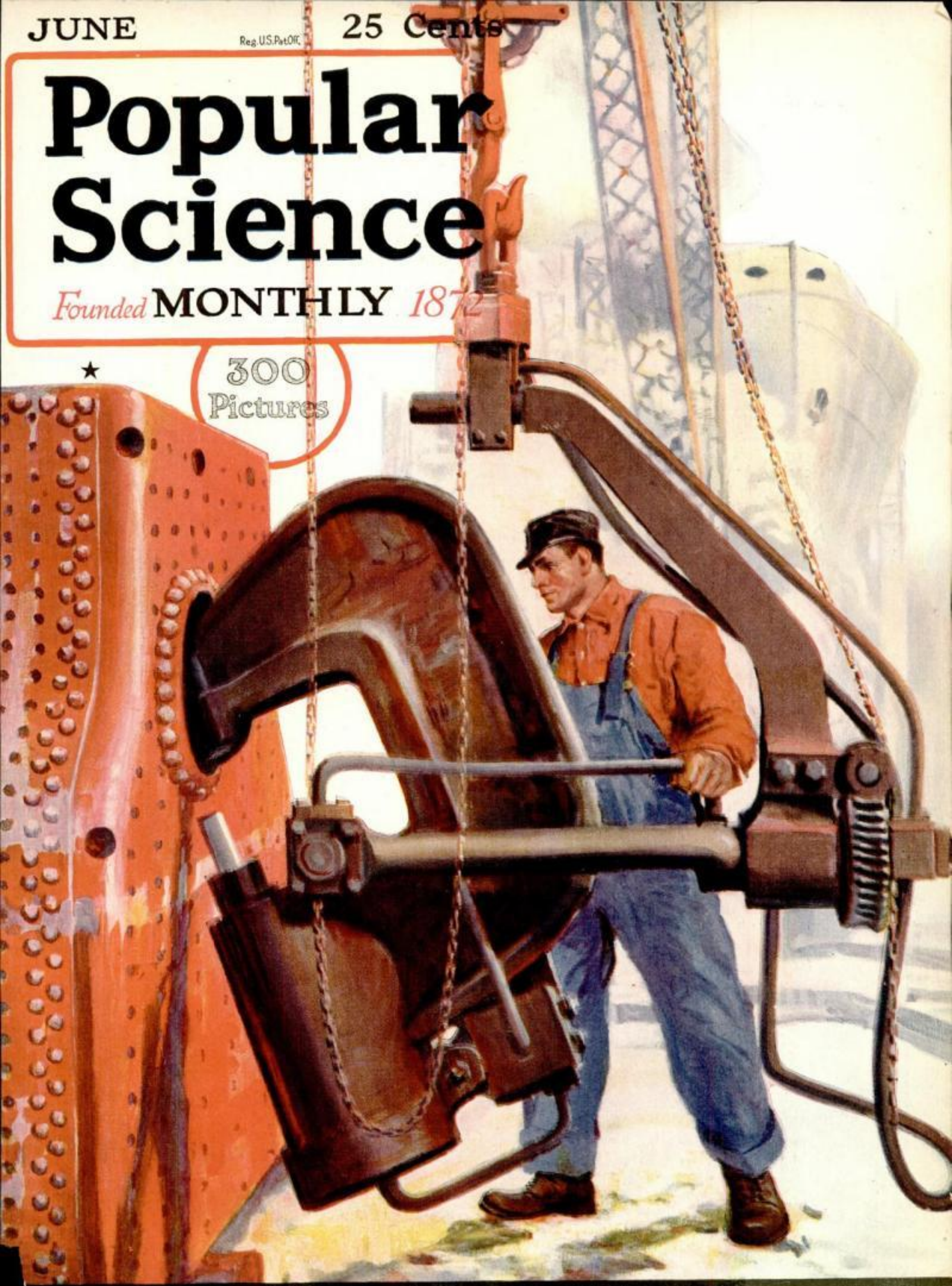
25 Cents

# Popular Science

*Founded* MONTHLY 1872

★

300  
Pictures





"Well, well—  
here we are again"

CHESTERFIELD advertising  
keeps telling you that Chester-  
fields "satisfy."

And every day, new hundreds of  
smokers try Chesterfields and learn  
the truth—that Chesterfields *do*  
"satisfy."

Right now, there are over three  
million smokers—over three million  
friends—who know the "satisfying"  
quality of Chesterfield's can't-be-  
copied blend of fine Turkish and  
Domestic tobaccos.

They know—

"They Satisfy."

*Liggett & Myers Tobacco Co.*



~ and the blend can't be copied



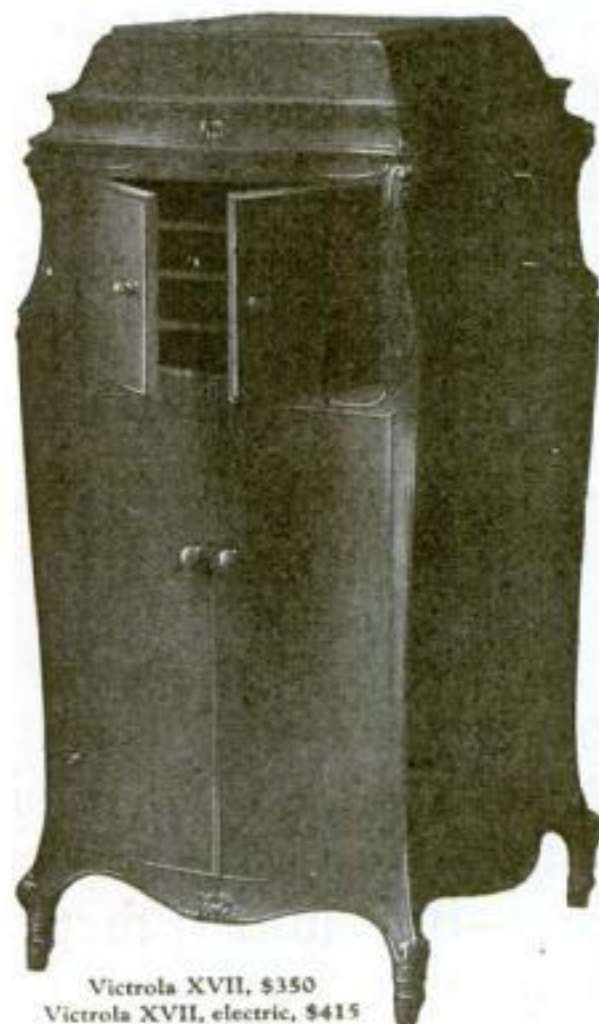
# With the Victrola and Victor Records you hear the greatest artists just as they wish to be heard

*Your* interpretation of a piece of music may be in itself a highly artistic achievement, but not if superimposed on the interpretation of a master. It then would be neither one thing nor the other.

The Victrola is equipped with doors so that the volume of tone may be regulated to suit varying conditions. They are not intended to be used in imposing amateur "interpretations" upon those of the world's greatest artists, for that would be to lose the very thing you seek—the finest known interpretations of music.

A Victor Record of Caruso is Caruso himself—provided always that some less qualified person shall not tamper with what the artist himself has done.

Victrolas \$25 to \$1500. Victor dealers everywhere. New Victor Records on sale at all dealers on the 1st of each month.



Victrola XVII, \$350  
Victrola XVII, electric, \$415  
Mahogany or oak

## VICTROLA

REG U S PAT OFF

is a trademarked word which identifies products manufactured by the

### Victor Talking Machine Co.

Camden, New Jersey



This trademark and the trademarked word "Victrola" identify all our products. Look under the lid! Look on the label!  
VICTOR TALKING MACHINE CO.  
Camden, N. J.



# Popular Science Monthly

JUNE, 1920

Volume 96-No. 6

## CONTENTS

### AERONAUTICS

"Reaching the Ceiling" on the Ground.....	25
A Double-Decker Airplane.....	35
Quieting the Airplane.....	43
A New Giant of the Air.....	61
Elephants on Parade.....	62

### FOR THE FARMER

Killing Weeds by Steam.....	26
Digging 50,000 Trees a Day.....	42
Scarecrow Guardians of the Cherry-Tree.....	43
A Trap to Catch Ants.....	44
Weighing Crops in the Field.....	45
Keep Hens from Setting at the Wrong Time.....	67
Baths for Wheat Keep It Healthy.....	68
Automatic Pitchforks.....	66

### HOUSEKEEPING MADE EASY

Air Without Drafts.....	52
Making the Fly-Paper Stick to Business.....	62
The Breakfast that Won't Get Cold.....	63
Fanning Flies to Destruction.....	65

### INDUSTRIAL PROGRESS

Submerge the Pump and Save the Sinking Ship..	25
A Folding Fan Increases Air Currents.....	34
Working Miracles in Your Own Business.....	37
Making Crates of the Once Useless Cottonwood	41
Canned Heat for the Soldering-Iron.....	44
Laying a Roof by Machine Saves Time.....	46
This Searchlight Melts Lead.....	50
Safety Devices to Guard the Power-Press Worker	52
Clearing the Railway Right of Way.....	53
He Got Ten Thousand Dollars for an Idea.....	55
One Canal Dives Under Another.....	58
A Giant with the Touch of a Child.....	60
Taking the Sting Out of the Bullet.....	40
Turn the Table and Lock It.....	65
Rewards for Cleanliness Bring Quick Results...	66
How Money Can be Made from the Scrap-Pile..	66
Making Bamboo Needles for the Phonograph..	66
Cutting through Steel Ship-Plates Under Water	69
Harnessing the Sun's Rays.....	72
A Self-Destroying Box.....	74
Return Empty Crates for Refilling.....	75
Carry a Light About Without Holding It.....	76
A Seat for the Barber.....	76
Filling Without Spilling.....	77
Why Does Iron Rust?.....	84
Let It Down on the Pad.....	86

(Continued on page 4)

Copyright, 1920, by the Modern Publishing Company  
POPULAR SCIENCE MONTHLY is issued monthly.  
Yearly subscription in the United States, \$3.00.  
Canada, \$3.50. Foreign, \$4.00. Single copy, 25 cents.  
POPULAR SCIENCE MONTHLY may be had at all news-  
stands in the United States and Canada; also from the  
International News Company, London, and at Bren-  
tano's, Paris.

Advertising rates on application. Forms close the  
twentieth of the second month preceding date of  
publication. Entered as second-class matter Dec. 28,  
1915, at the Post Office at New York under the act of  
March 3, 1879. Entered as second-class matter at  
the Post Office Department, Canada.

The contents of this magazine are copyrighted  
and must not be reprinted without permission.  
H. J. Fisher, President; R. C. Wilson, Vice-President;  
O. B. Capen, Secretary and Treasurer.

Modern Publishing Company  
25 West Thirty-ninth St. New York City

NOW, CYPRESS, the Wood Eternal, is the Champion Pergola Lumber—you can see why. The same goes for arbors, trellises, sleeping balconies (dahlia stakes might be mentioned) and pasture fences. Also for Colonial doorways. Likewise barns. Not to mention Library Interiors (with sugi finish) and humble kitchen sinks that don't warp. CYPRESS is "some wood."

It is possible that we might have a booklet you could use to advantage—we have 43 of them in the Cypress Pocket Library. Some have plan-sheets—big and practical and artistic—and exclusive—and they cost us something—you nothing. Volume One contains the list. Also what the Government of the U. S. A. says about Cypress, "the Wood Eternal." Our address is below. What is yours? Is it all right to ask?

*All-round Helps Department*

## Southern Cypress Mfrs.' Ass'n.

1249 Hibernia Bank Building, New Orleans, Louisiana  
1249 Heard National Bank Building, Jacksonville, Florida

SPECIFY AND INSIST ON "TIDEWATER" CY-  
PRESS IDENTIFIED BY THE CYPRESS ASSN'S.  
REGISTERED TRADE-MARK. IF IN ANY  
DOUBT, PLEASE WRITE US IMMEDIATELY.



# A Startling Memory Feat That You Can Do

**How I learned the secret in one evening. It has helped me every day**

WHEN my old friend Faulkner invited me to a dinner party at his house, I little thought it would be the direct means of getting me a one-hundred-and-fifty per cent increase in salary. Yet it was, and here is the way it all came about.

Toward the close of the evening things began to drag a bit, as they often do at parties. Finally some one suggested the old idea of having everyone do a "stunt." Some sang, others forced weird sounds out of the piano, recited, told stories, and so on.

Then it came to Macdonald's turn. He was a quiet sort of chap, with an air about him that reminded one of the old saying that "still waters run deep." He said he had a simple "stunt" which he hoped we would like. He selected me to assist him. First he asked to be blindfolded securely to prove there was no trickery in it. Those present were to call out twenty-five numbers of three figures each, such as 161, 249, and so on. He asked me to write down the numbers as they were called.

This was done. Macdonald then astounded everyone by repeating the entire list of twenty-five numbers backwards and forwards. Then he asked people to request numbers by positions, such as the eighth number called, the fourth number, and so on. Instantly he repeated back the exact number in the position called. He did this with the entire list—over and over again, without making a single mistake.

Then Macdonald asked that a deck of cards be shuffled and called out to him in their order. This was done. Still blindfolded, he instantly named the cards in their order backwards and forwards. And then to further amaze us, he gave us the number of any card counting from the top, or the card for any number.

You may well imagine our amazement at Macdonald's remarkable feat. You naturally expect to see a thing of this sort on the stage, even then you look upon it as a trick. But to see it done by an everyday business man, in plain view of everyone, blindfolded and under conditions which make trickery impossible, is astonishing, to say the least.

ON the way home that night I asked Macdonald how it was done. He said there was really nothing to it—simply a memory feat, the key to which anyone could easily learn in one evening. Then he told me that the reason most people have bad memories is because they leave memory development to chance. Anyone could do what he had done, and develop a good memory, he said, by following a few simple rules. And then he told me exactly how to do it. At the time I little thought that evening would prove to be one of the most eventful in my life, but such it proved to be.

What Macdonald told me I took to heart. In one evening I made remarkable strides toward improving my memory and it was but a question of days before I learned to do exactly what he had done. At first I amused myself with my new-found ability by amazing people at parties. My "memory feat," as my friends called it, surely made a hit. Everyone was talking about it, and I was showered with invitations for all sorts of affairs. If anyone were to ask me how quickly to develop social popularity, I would tell him to learn my memory "feat"—but that is apart from what I want to tell you.

The most gratifying thing about the improvement

of my memory was the remarkable way it helped me in business. Much to my surprise I discovered that my memory training had literally put a razor edge on my brain. My brain had become clearer, quicker, keener. I felt that I was fast acquiring that mental grasp and alertness I had so often admired in men who were spoken of as "wonders" and "geniuses."

The next thing I noticed was a marked improvement in my conversational powers. Formerly my talk was halting and disconnected. I never could think of things to say until the conversation was over. And then, when it was too late, I would always think of apt and striking things I "might have said." But now I can think like a flash. When I am talking I never have to hesitate for the right word, the right expression or the right thing to say. It seems that all I have to do is to start to talk instantly I find myself saying the very thing I want to say to make the greatest impression on people.

It wasn't long before my new-found ability to remember things and to say the right thing at the right time attracted the attention of our president. He got in the habit of calling me in whenever he wanted facts about the business. As he expressed himself to me, "You can always tell me instantly what I want to know, while the other fellows annoy me by dodging out of the office and saying 'I'll look it up.'"

I FOUND that my ability to remember helped me wonderfully in dealing with other people, particularly in committee meetings. When a discussion opens up the man who can back up his statements quickly with a string of definite facts and figures usually dominates the others. Time and time again I have won people to my way of thinking simply because I could instantly recall facts and figures. While I'm proud of my triumphs in this respect, I often feel sorry for the ill-at-ease look of the other men who cannot hold up their end in the argument because they cannot recall facts instantly. It seems as though I never forget anything. Every fact I now put in my mind is as clear and as easy to recall instantly as though it were written before me in plain black and white.

We all hear a lot about the importance of sound judgment. People who ought to know say that a man cannot begin to exercise sound judgment until he is forty to fifty years of age. But I have disproved all that. I have found that sound judgment is nothing more than the ability to weigh and judge facts in their relation to each other. Memory is the basis of sound judgment. I am only thirty-two, but many times I have been complimented on having the judgment of a man of forty-five. I take no personal credit for this—it's all due to the way I trained my memory.

THESE are only a few of the hundreds of ways I have profited by my trained memory. No longer do I suffer the humiliation of meeting men I know and not being able to recall their names. The moment I see a man his name flashes to my mind, together with a string of facts about him. I always liked to read but usually forgot most of it. Now I find it easy to recall what I have read. Another surprising thing is that I can now master a subject in considerably less time than before. Price lists, market quotations, data of all kinds, I can recall in detail almost at will. I rarely make a mistake.

My vocabulary, too, has increased wonderfully. Whenever I see a striking word or expression, I memorize it and use it in my dictation or conversation. This has put a remarkable sparkle and pulling power into my conversation and business letters. And the remarkable part of it all is that I can now do my day's work quicker, and with much less effort, simply because my mind works like a flash and I do not have to keep stopping to look things up.

All this is extremely satisfying to me, of course.



But the best part of it all is that since my memory power first attracted the attention of our president, my salary has steadily been increased. Today it is many times greater than it was the day Macdonald got me interested in improving my memory.

WHAT Macdonald told me that eventful evening was this: "Get the Roth Memory Course." I did. That is how I learned to do all the remarkable things I have told you about. The publishers of the Roth Memory Course—the Independent Corporation—are so confident that it will also show you how to develop a remarkable memory that they will gladly send the Course to you on approval.

You need not pay a single penny until you have examined the Course and found that it fully lives up to all the claims made for it. Send no money. Merely mail the coupon or write a letter, and the complete Course will be sent to you instantly, all charges prepaid. If after examination you decide that you do not want to keep the Course, then return it and you will owe nothing. On the other hand, if you find, as thousands of others have found, that the Roth Memory Course will do wonders for you, then merely send seven dollars in full payment.

You have always wanted a good memory. Now you can have it. Remember, you pay no money until you have proved that the Course will benefit you. You have everything to gain and nothing to lose by taking immediate action. So mail the coupon NOW before this liberal offer is withdrawn. Independent Corporation, Dept. R-776, 319 Sixth Avenue, New York.

## Free Examination Coupon

### INDEPENDENT CORPORATION

*Publishers of The Independent Weekly*

Dept. R-776, 319 Sixth Avenue, New York

You may send me the Course or Courses checked below. Within five days after receipt I will either return the course (or courses) or send you price indicated after each in full payment.

- ☐ Roth Memory Course (\$7).  
By David M. Roth.
- ☐ Mastery of Speech (\$7).  
By Frederick Houk Law.
- ☐ How to Read Character at Sight (\$7).  
By Dr. K. M. H. Blackford.
- ☐ Super-Salesmanship (\$7).  
By Arthur Newcomb.
- ☐ Practical Course in Personal Efficiency (\$7).  
By Edward Earle Purinton.
- ☐ Ferrin Home-Account System (\$3.50).  
By Wesley W. Ferrin.
- ☐ Paragon Shorthand Course (\$7).
- ☐ The Lederer Art Course (\$6.50)  
By Charles Lederer.
- ☐ Independent Weekly (\$5).  
(52 issues—15c per copy.)

Name .....

Address .....

Pop. Science 6-20



## CONTENTS—Continued

## MEDICINE AND SURGERY

Trials of a Knock-Kneed Young Llama.....	34
If Your Child Swallows a Safety-Pin.....	36
Fighting Disease with Light Rays.....	63
The Mysteries of the Light that Cures.....	77

## MOTOR VEHICLES AND ACCESSORIES

Good Roads at a Mile a Week.....	26
Automobile-Power.....	43
Cranking Up the Automobile Window.....	80
Only Two Gears in this Electric Drive.....	80
It's a Farm Tractor and a Motor-Truck Too.....	81
Carrying the Bible by Motor.....	85
If You Could Look Inside a Tractor.....	85
A Jointed Jack.....	85
Hydraulic Hoist for Motor-Truck Body.....	86
Making Your Motor Upkeep Less Expensive.....	87

## NATURAL SCIENCE

If the Eye Were a Telescope.....	21
How the Worm Gets in the Hazelnut.....	27
Nature Presents Her Gas Bill.....	31
An Ugly Giant Crab of Japan.....	42
Bossy's Fifth Leg.....	44
An Apple-Tree of Sixty.....	44
A Snake Memento.....	62
A Feathered Robber Baron of the Air.....	62
The Eel and the Tortoise.....	62
Two Eggs that Grew as One.....	64
A Home With a Barbed Wire Fence for the Owl.....	67
Raising Butterflies for the Market.....	75

## PICTORIAL PAGES

Peace-Time Jobs for Aerial Photography.....	28
Where There's a Thirst There's a Way.....	29
Stay-at-Home Models of Ocean Travelers.....	48
Ask Dad—He Knows!.....	49
A Quick Method of Loading Motor-Trucks.....	51
Things You Can Do with a Roof.....	59
Lightening the Burdens of a Bachelor.....	57
Brain versus Brawn in the Struggle for Existence.....	70
Housekeeping Made Easy.....	78
Do It With Tools and Machines.....	79
New Things for the Motorist.....	82

## SHIPS AND SHIPBUILDING

A Life-Line Gun that Can't Fail.....	46
These Harmless-Looking Boats Are Destroyers.....	53
A Tip from the Circus.....	74
Glass Houses for Marine Searchlights.....	74

## SPORTS AND PASTIMES

Coasting on the Summer-Winter Sled.....	26
Gliding Down a Thousand Feet.....	27
The "Movies" Ancestor.....	35
Take Your Money with You When You Swim.....	45
A Doll's House Equipped for the Queen of Dolls.....	65
Argentina—That's the Place to Travel In.....	65
More Speed from the Pedals of Your Bicycle.....	67
Use Your Canoe for an Umbrella When It Rains.....	67
Tourist Folding Tent.....	74

## MISCELLANY

Safety First for Experimenters in Kite-Flying.....	26
As Cannibals See Themselves.....	27
A Voice Spoke from the Storm.....	30
Get Your Own Goat.....	34
Sailors on the Half-Shell.....	34
In the Age of Machinery!.....	34
By Their Hats Ye Shall Know Them.....	35
Lunch, Twenty Cents.....	35
In the Land of the Maoris.....	35
This School Expands to Fit the Pupils.....	41
Safety First Moving Pictures in a Mine.....	42
In Leisurely Korea.....	42
Working with Death.....	42
The Pig that Came in the Air Mail.....	43
Billy's Nurse.....	43
He Carries His Tools with Him.....	44
An Indian Barber-Shop.....	45
Telling Time All Over the World.....	45
Notes by Pocket-Light.....	45
Rich Iron Mines in Air We Breathe.....	47
A Fountain-Pen Cup.....	52
She Sells Phonograph Records by Telephone.....	52
As Others See It.....	52
\$1,000 Reward.....	53
Boulders to Right of It, Boulders to Left of It.....	53
They Love Their Tea.....	53
He Has Built Fame with Cardboard.....	54
Fashions in Canes.....	63
The House Built of Powder-Puffs.....	63

(Continued on page 6)

# Make a Bigger Income Learn Draftsmanship



Great demand for draftsmen now. Still greater demand in prospect. War over, building is to be resumed and manufacturing to expand to meet home and foreign needs—which means plenty of good positions for draftsmen. Take up this paying profession. The Chicago "Tech" method is the quickest, easiest way to become a draftsman in spare time while you hold your present position. That proved before you pay a penny. (See free lesson offer below.) Send coupon. Learn how to earn

## \$25 to \$100 a Week or More

at interesting work with opportunities to rise to superintendent, manager, or other executive positions. Let the Chicago "Tech" engineers train you. At least get the free lesson and information.

### Drawing Outfit



(No Extra Charge)

Every student of the Chicago "Tech" Home Study Course

in Draftsmanship receives this drawing outfit—set of instruments in case, drawing board, T square, triangles, scale, curve, drawing paper, pencils, etc., or a cash credit in case he already has an outfit. These instruments are of the same make and sizes as used by high salaried experts in drafting rooms of factories, shops, railroads, etc. You use them while learning—then take them right into your practical work.

**NOTE:** Enrolled with Chicago "Tech" you have the personal direction of practical engineers, builders and architects who teach you the methods they use in their own work. No useless theories, no time wasted. You are prepared to stand beside old, experienced men. Big advantage to learn from a staff like this—every man a specialist.

### Come to the College or TRAIN at HOME

Wherever you are you can have this Chicago "Tech" training. Complete instruction by mail. Exercises, lessons, personal direction of our experts right in your own home if you cannot come to the college for a resident course. Send the Coupon and get the facts.

### Easy Payments

The fees for Chicago "Tech" courses are very moderate—and you can pay on easy terms. And also—you can obtain in a few months what it would take several years to acquire by ordinary methods. You can get an early start. You are soon ready to take a paying position and to quickly get back the cost of your course.

## FREE TEST LESSON

Other institutions ask you to pay first—and then to find out later how well qualified you are for this profession. We send the free lesson first and place you under no obligation at all. Discover your qualifications before you pay anything. And see for yourself just what Chicago "Tech" offers you in training which will bring a ready market for your services and open opportunities which are closed to the untrained man. The coupon will bring all the facts about the course, the small fee, and the easy terms.

## NOW

Mark with X the branch you are interested in—or if in doubt about which course to take, write a letter stating facts about yourself and asking our advice, which will be freely given. Mail either the coupon or the letter today



### CHICAGO TECHNICAL COLLEGE, 631 Chicago "Tech" Building, Chicago

Without obligation upon me, send your Catalog on subject indicated below. Also FREE Lesson, if inquiry is on Drafting or Plan Reading.

Mark X opposite work in which you are especially interested

- |   |   |
|---|---|
| <input type="checkbox"/> Architectural Drafting | <input type="checkbox"/> Plan-Reading—Buildings |
| <input type="checkbox"/> Machine Drafting       | <input type="checkbox"/> Plan-Reading—Shop Men  |
| <input type="checkbox"/> Electrical Drafting    | <input type="checkbox"/> Estimating             |
| <input type="checkbox"/> Structural Drafting    | <input type="checkbox"/> Surveying              |
| <input type="checkbox"/> Sheet Metal Drafting   | <input type="checkbox"/> Aeronautics            |
| <input type="checkbox"/> Builders' Course       | <input type="checkbox"/> Autos and Gas Engines  |

Name.....

Address.....

City.....State.....

College or Home Study? State which.....

### Auto and Gas Engine Course

All about automobile mechanism—its construction, operation and REPAIR—taught by mail. You train directly under the Chicago "Tech" automobile experts. Splendid opportunities open now.

#### Learn All This in Spare Time

All about the principles of the Automobile.  
All about Gasoline Engines.  
All about Power Plants and Transmissions.  
All about Carburetors and Fuel Supply Systems.  
All about Lubrication and Cooling.  
All about Batteries.  
All about Magneto Ignition.  
All about Starting and Lighting Systems.

### AERONAUTICS

Complete Course in Aeronautic Engineering. Every principle made clear. Equips you for expert work.

**Write** Send the coupon and get catalog and all information now.

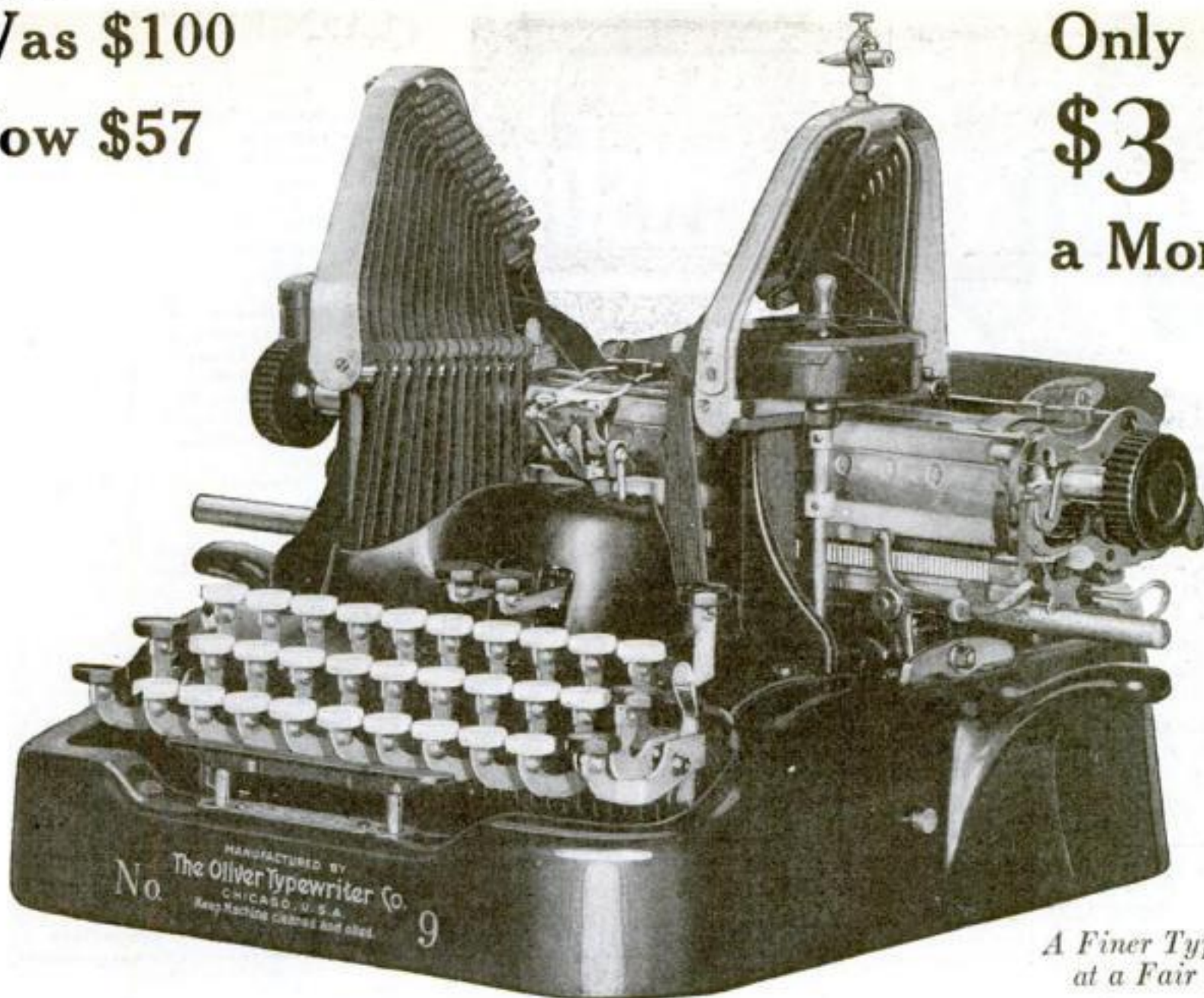


June, 1920

Was \$100

Now \$57

Only  
**\$3**  
a Month



*A Finer Typewriter  
at a Fair Price*

# Send No Money!

No money in advance. Not a cent! Simply make your request via the coupon below if you want this brand new Oliver Typewriter for five days free trial in your own home or office. Use this Oliver for five days as if it were your own. Type all your letters or any other work with it. Put it to every conceivable test. Compare it with any \$100 typewriter on the market. Compare it for simplicity of construction. For beauty of finish. For ease of operation. For speed. For neatness of work. Then

if after 5 days free trial you do not wish to keep the typewriter for any reason whatsoever, simply send it back to us and you won't be out one cent for the free trial. If, on the other hand, you decide that it is the finest typewriter, and you wish to keep it, then pay us at the easy rate of only \$3 a month. This is the open, free trial offer we make to you on the Oliver to let you see for yourself that if any typewriter is worth \$100 it is this splendid, speedy Oliver No. 9, our latest model and the finest we ever built.

## Famous Users of the Oliver

Columbia Graphophone Co.  
Pennsylvania Railroad  
National City Bank of N. Y.  
Boston Elevated Railway  
Hart, Schaffner & Marx  
U. S. Steel Corporation  
New York Edison Company  
American Bridge Company  
Diamond Match Company

**Save \$43** For \$57 you can now obtain the identical Oliver Typewriter formerly priced at \$100. We are able to save you nearly half because of our radically new and economical method of distribution. During the war we learned many lessons. We found that it was unnecessary to have such a vast number of traveling salesmen and so many expensive branch houses throughout the country. We were able to discontinue many other superfluous sales methods. Result—we can afford to sell at \$57 the very same Oliver formerly priced at \$100.

### Mail the Coupon Now

Check the coupon to get the Oliver for five days free trial in your own home. If you decide to keep the typewriter you can pay for it on terms so easy that you won't miss the money—only \$3 a month. If you prefer to have further information before ordering, fill in the coupon for our free catalog. Clip the coupon now and mail it at once.

Canadian Price, \$72

**The OLIVER Typewriter Company**

1106 Oliver Typewriter Bldg., Chicago, Ill.

## The OLIVER Typewriter Company

1106 Oliver Typewriter Bldg., Chicago, Ill.

☐ Ship me a new Oliver Nine for five days free inspection. If I keep it, I will pay \$57 at the rate of \$3 per month. The title to remain in you until fully paid for.

My shipping point is \_\_\_\_\_  
This does not place me under any obligation to buy. If I choose to return the Oliver, I will ship it back at your expense at the end of five days.

☐ Do not send a machine until I order it. Mail me your book—"The High Cost of Typewriters—The Reason and the Remedy," your de luxe catalog and further information.

Name \_\_\_\_\_

Street Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

Occupation or Business \_\_\_\_\_



## CONTENTS—Continued



## BECOME AN EXPERT ACCOUNTANT

### The Profession That Pays Big Incomes

Never before have there been so many splendid opportunities for trained accountants—men whose training combines a knowledge of Auditing, Cost Accounting, Business Law, Organization, Income Tax Work, Management and Finance. Few professions offer better opportunities to young men of ambition and intelligence. The tremendous business growth of this country has created a rich field for the expert. There are only about 3,000 Certified Public Accountants to do the work of the half million concerns needing proficient accounting service. The expert accountant is needed today in every big business organization.

### Knowledge of Bookkeeping Unnecessary to Begin

If you are ambitious, you can train for one of these big positions. The LaSalle method will train you by mail under the direct supervision of William B. Castenholz, A. M., C. P. A., former Comptroller and Instructor, University of Illinois, assisted by a large staff of Certified Public Accountants including members of the American Institute of Accountants. You will be given whatever training, instruction or review on the subject of bookkeeping you may personally need—and without any expense to you. Our big free book on the accountancy profession fully explains how we train you from the ground up, according to your individual needs, from the simplest bookkeeping principles to the most advanced accounting problems. All text material supplied in the course has been especially prepared in clear, easy-to-understand language so that you can readily master the principles by home study.

### Send for the Facts Now

Mail the coupon now and get our free book which fully describes our expert training course and tells all about our Money-Back Guarantee, C. P. A. examinations, state regulations, salaries and incomes, and how you can qualify for a high-grade accounting position without interference with your present position. Send in the coupon and find out how we have helped over 200,000 ambitious men, and learn what we can do for you.

### Valuable Book FREE

A prominent Chicago executive says: "Get this book 'Ten Years' Promotion In One,' even if it costs you \$5.00 for a copy." Let us send it to you free, with literature explaining how you can train for a Higher Accountancy job without interference with your present duties. Send coupon today—NOW.



— MAIL THIS COUPON —  
**LaSALLE EXTENSION UNIVERSITY**  
"The Largest Business Training Institution in the World"  
Dept. 683-H Chicago, Illinois

Send at once, without cost or obligation to me, your valuable book, "Ten Years' Promotion In One," also your book of Accountancy Facts and full details of your course in Higher Accounting.

Name.....  
Present Position.....  
Address.....



## SELLING SECRETS That Bring This Man \$10,000 a Year

FROM fireman on an Eastern railroad to \$10,000 a-year Star Salesman in one jump! P. T. Balsbaugh whose picture appears above did it! He's taken his place in the ranks of the big money makers. \$10,000 a year as a Salesman—and he never sold goods before!

How did he do it? Simply by learning the secrets of successful salesmanship from Master Salesmen and Sales Managers through the National Salesmen's Training Association.

Think what you could do with his splendid income! You could own your own home, have money in the bank, drive a car and have many of the luxuries that make life worth living. What Balsbaugh did, you too can do.

### Why Don't YOU Get into the Selling Game?

The quickest way to earn big money is in the selling game. Be a Star Salesman. You can learn the secrets of selling as thousands have done. Our amazing methods make mastery of Salesmanship easy for any man who wants to succeed. You don't have to lose a day or a dollar from your present job—just a part of your spare time will do.

### FREE Proof that You Can Be a Star Salesman

Mail the coupon below. It will bring you a wonderful book entitled "A Knight of the Grip." In it you will find the proof that you, too, can do as Balsbaugh did, as thousands have done through this System. See for yourself the wonderful opportunities in this fascinating profession. Learn how you can quickly qualify.

**We Help You Land a Selling Job** No long apprenticeship by this wonderful system. Just as soon as you are ready and qualified the Employment and Service Department of the N. S. T. A. will help you select and secure a good selling position. The moment you are a Salesman your chances for making money are unlimited.

LOSE NO TIME! Mail the coupon right now—this minute. Address:

**National Salesmen's Training Association**  
Dept. 15-G Chicago, Ill., U. S. A.

**National Salesmen's Training Association**  
Dept. 15-G, Chicago, Ill., U. S. A.

With no obligation on my part, please send me "A Knight of the Grip" and full information about the N. S. T. A. Training and Employment Service. Also a list showing lines of business with openings for salesmen.

NAME.....  
STREET.....  
CITY.....  
STATE.....

Stockings Come High!	63
The Line Doesn't Tangle in This Container	64
The Importance of Railroad Tie Spikes	64
A Folding Trestle for the House-Painter	64
How One Cobbler Attracts Patrons	65
Getting Music through a Shell	66
Taking Kinks Out of Street-Car Tracks	68
Counting Miles on a Typewriter	68
The Great Junk-Heap of Panama	69
A Room and Bed	72
Tongues Out!	72
Feeling What Time It Is	72
The Writing on the Rock	72
Diamond Double Eagle	73
To Protect Eye-Glasses	73
Midshipmen of the Air Sail High	73
Shall We Have 13 o'Clock?	73
Dial Measures Dimensions	73
The Vampire	75
Trapping Walnuts	75
Chief Shake's War Canoe	76
The Man Higher Up	76
A Glass of Water with a Kick	76
All Four Feet Off the Ground	77
A Traveling Bar Is a Convenience of the Tropics	77
To Detect Flaws in Diamonds	77

### PRACTICAL WORKERS

Define the Electrical Current	90
A Jig for Drilling Round Stock Accurately	94
Washing Your Car in the Approved Way	96
How to Make a Stepless Transformer	100
A Paint-Spraying Device that Saves Effort	100
Ford-Owners May Safely Go Out in the Rain	102
A Disappearing Clothesline-Pole for Your Yard	102
Measuring Angles with a Watch	104
Weighing Poultry on Homemade Scales	104
Allow Your Automobile Engine to Breathe	106
Buggy-Axles and Wheel-Hubs for Gate-Hinges	106
Taking the Dents Out of a Gasoline-Tank	108
A Quick Method of Lining Up Lathe Centers	112
A Safety Handle Holder Makes Drilling Safer	114
Before the Flood: First Aid for the Leaky Pipe	116
Make Runners for the Top of Your Harrow	116
A Tire-Opener Gives the Motorist a Third Hand	118
Growing Potatoes in a Pen Saves Garden Space	119
How to Make a Lathe-Milling Attachment	121
You Can't Have Eggs and Mites	122
Make a Support for Spark-Plug Wires	123
An Alligator Wrench You Can Make at Home	123
A Pneumatic Punch from an Old Gas Engine	124
A Metal Holder Used as a Tool-Box	125
Keep Your Distributor Clean and Dry	125
Balance Your Armatures and Eliminate Noise	126
Utilizing the Hollow Handles of a Die-Stock	126
Use a Simple Air-Blast for Your Power-Saw	127
An Improvement on the Artist's Pantograph	128
Keep Your Eye on the Automobile Generator	128
An Easy Way to Put Wire-Cloth on Doors	129
How to Tie the Invisible Armature Knot	130
An Indirect-Lighting System for the Home	131
Don't Throw Away Your Old Window-Shades	131
A Large Hinge Serves as a Clamp for Tire Repair	132
A Gravity Electric Bell Made of Odds and Ends	132
Saving Eyes and Time in Concrete-Drilling	134
A Bicycle-Pump Makes a Spray Gun	135
Accurate Angles by a Table of Tangents	135
Attaching a Trunk-Handle to a Locked Trunk	136
How Eye-Bolts Can be Made from Cotter-Pins	136
To Make a Hand-Power Milling Attachment	137
You Can Make Your Own Vacuum Bottle	139
The Neatest Mechanical Job I Ever Saw Contest	140
A Simple Sandpaper-Holder for Carpenters	153
A Battery-Connector of Sheet Metal	153
Baffling the Ingenuity of the "Tool-Borrower"	154
This Obliging Engine Pumps Water at a Distance	154
To Make a Block of Timber Serve as a Vise	155
Detachable Poster-Boards for Motor-Trucks	155
When You Get Down and Get Under	156
Aligning the Centers on a Lathe	156
How to Make a Quick and Lasting Pipe Repair	157
How to Make Quick, Smooth Erasures	157
Tapping Small Pieces in a Drill-Press	158

### RADIO

The Thermionic Oscillator—III	142
A Musical Scale from an Oscillating Audion	145
A Circuit Layout for a Radio Editor	147
Radio Equipment for Pleasure Craft	148
Directing Mail Airplanes by Wireless	149
Experiment Vacuum-Valve Detectors	150
Variable Grid Leak in a Novel Mounting	151
Making a Vacuum-Tube Control Panel	152





# Free Proof that I Can Raise Your Pay

No matter how much you are earning now, I can show you how to increase it. I have even taken failures and shown them how to make \$100—\$200, and in one case as high as \$2,000 weekly. I am willing to prove this entirely at my risk and expense.

LET'S have a little chat about getting ahead—you and I. My name is Pelton. Lots of people call me "The Man Who Makes Men Rich." I don't deny it. I've done it for thousands of people—lifted them up from poverty to riches.

I'm no genius—far from it. I'm just a plain, everyday, unassuming sort of man. I know what poverty is. I've looked black despair in the eye—had failure stalk me around and hoodoo everything I did. I've known the bitterest kind of want.

But today all is different. I have money and all of the things that money will buy. I am rich also in the things that money won't buy—health, happiness and friendship. Few people have more of the blessings of the world than I.

IT was a simple thing that jumped me up from poverty to riches. As I've said, I'm no genius. But I had the good fortune to know a genius. One day this man told me a "secret." It had to do with getting ahead and growing rich. He had used it himself with remarkable results. He said that every wealthy man knew this "secret"—that is why he was rich.

I used the "secret." It surely had a good test. At that time I was flat broke. Worse than that, for I was several thousand dollars in the hole. I had about given up hope when I put the "secret" to work.

At first I couldn't believe my sudden change in fortune. Money actually flowed in on me. I was thrilled with a new sense of power. Things I couldn't do before became as easy for me to do as opening a door. My business boomed and continued to leap ahead at a rate that startled me. Prosperity became my partner. Since that day I've never known what it is to want for money, friendship, happiness, health or any of the good things of life.

That "secret" surely made me rich in every sense of the word.

MY sudden rise to riches naturally surprised others. One by one people came to me and asked me how I did it. I told them. And it worked for them as well as it did for me.

Some of the things this "secret" has done for people are astounding. I would hardly believe them if I hadn't seen them with my own eyes. Adding ten, twenty, thirty or forty dollars a week to a man's income is a mere nothing. That's merely playing at it. In one case I took a rank failure and in a few weeks had him earning as high as \$2,000.00 a week. Listen to this:

A young man in the East had an article for which there was a nation-wide demand. For twelve years he "puttered around" with it, barely eking out a living. Today this young man is worth \$200,000. He is building a \$25,000 home—and paying cash for it. He has three automobiles. His children go to private schools. He goes hunting, fishing, traveling whenever the mood strikes him. His income is over a thousand dollars a week.

In a little town in New York lives a man who two years ago was pitied by all who knew him. From the time he was 14 he had worked and slaved—and at sixty he was looked upon as a failure. Without work—in debt to his charitable friends, with an invalid son to support, the outlook was pitchy black.

Then he learned the "secret." In two weeks he was in business for himself. In three months his plant was working night and day to fill orders. During 1916 the profits were \$20,000. During 1917 the profits ran close to \$40,000. And this genial 64-year-old man is enjoying pleasures and comforts he little dreamed would ever be his.

I COULD tell you thousands of similar instances. But there's no need to do this as I'm willing to tell you the "secret" itself. Then you can put it to work and see what it will do for you.

I don't claim I can make you rich over night. Maybe I can—maybe I can't. Sometimes I have failures—everyone has. But I do claim that I can help 90 out of every 100 people if they will let me.

The point of it all, my friend, is that you are using only about one-tenth of that wonderful

brain of yours. That's why you haven't won greater success. Throw the unused nine-tenths of your brain into action and you'll be amazed at the almost instantaneous results.

The Will is the motive power of the brain. Without a highly trained, inflexible will, a man has about as much chance of attaining success in life as a railway engine has of crossing the continent without steam. The biggest ideas have no value without will-power to "put them over." Yet the will, altho heretofore entirely neglected, can be trained into wonderful power like the brain or memory and by the very same method—intelligent exercise and use.

If you held your arm in a sling for two years it would become powerless to lift a feather from lack of use. The same is true of the Will—it becomes useless from lack of practice. Because we don't use our Wills—because we continually bow to circumstances—we become unable to assert ourselves. What our wills need is practice.

Develop your will power and money will flow in on you. Rich opportunities will open up for you. Driving energy you never dreamed you had will manifest itself. You will thrill with a new power—a power that nothing can resist. You'll have an influence over people that you never thought possible. Success—in whatever form you want it—will come as easy as failure came before. And those are only a few of the things the "secret" will do for you. The "secret" is fully explained in the wonderful book "Power of Will."

## How You Can Prove This at My Expense

I KNOW you'll think that I've claimed a lot. Perhaps you think there must be a catch somewhere. But here is my offer. You can easily make thousands—you can't lose a penny.

Send no money—no, not one cent. Merely clip the coupon and mail it to me. By return mail you'll receive not a pamphlet, but the whole "secret" told in this wonderful book "POWER OF WILL."

Keep it five days. Look it over in your home. Apply some of its simple teachings. If it doesn't show you how you can increase your income many times over—just as it has for thousands of others—mail the book back. You will be out nothing.

But if you feel that "POWER OF WILL" will do for you what it has done for over four hundred thousand others—if you feel as they do that it's the next greatest book to the Bible—send me only \$3.50 and you and I'll be square.

If you pass this offer by, I'll be out only the small profit on a \$3.50 sale. But you—you may easily be out the difference between what you're making now and an income several times as great. So you see you've a lot—a whole lot—more to lose than I.

Mail the coupon or write a letter now—you may never read this offer again.

### SPECIAL NOTE

In nearly five years the price of "Power of Will" has been increased only 50c. We find it necessary now to raise the price to \$4.50 as soon as the present edition is gone. This means that by July 1st or sooner, the price must be increased to \$4.50.

**Pelton Publishing Company**  
14-K Wilcox Block Meriden, Conn.

**Pelton Publishing Company**  
14-K Wilcox Block, Meriden, Conn.

You may send me "Power of Will" at your risk. I agree to remit \$3.50 or return the book to you in five days.

Name .....

Address .....

## A Few Examples

### Personal Experiences

Among the 400,000 users of "Power of Will" are such men as Judge Ben B. Lindsey; Supreme Court Justice Parker; Wu Ting Fang, Ex-U. S. Chinese Ambassador; Assistant Postmaster General Britt; Gov. McKelvie of Nebraska; General Manager Christeson of Wells-Fargo Express Co.; E. St. Elmo Lewis, former Vice-pres. Art Metal Construction Co.; Gov. Ferris of Michigan; E. T. Meredith, Secy. of Agriculture, and many others of equal prominence.

### \$300 Profit from One Day's Reading

"The result of one day's study netted me \$300 in cash. I think it a great book and would not be without it for ten times the cost."—Col. S. W. Wilkie, Roscoe, So. Dakota.

### Worth \$15,000 and More

"The book has been worth more than \$15,000 to me."—Oscar B. Sheppard.

### Would Be Worth \$100,000

"If I only had it when I was 20 years old, I would be worth \$100,000 today. It is worth a hundred times the price."—S. W. Taylor, the Santa Fe Ry., Milam, Texas.

### Salary Jumped from \$150 to \$800

"Since I read Power of Will my salary has jumped from \$150 to \$800 a month."—J. F. Gibson, San Diego, Cal.

### From \$100 to \$3,000 a Month

"One of our boys who read Power of Will before he came over here jumped from \$100 a month to \$3,000 the first month, and won a \$250 prize for the best salesmanship in the state."—Private Leslie A. Still, A. E. F. France.



# QUICK-ACTION ADVERTISING

HERE READERS AND ADVERTISERS MEET TO TRANSACT BUSINESS

Rate 25 Cents a Word, no discounts.

Advertisements for the August issue should be received by June 1st.

## AUTOMOBILES AND ACCESSORIES

**AUTO Motor Supplies.** Buick, Michigan, Stoddard Dayton, Hupp 32, Cadillac, Overland, E. M. F., Continental and Buda Motors, all types, \$50 each and up. Bosch Magneto, \$15 each and up. Special high tension 2 and 4 cylinder magnetos, \$9.50 each. Prest-O-Lite tanks, \$5.00. Coils, carburetors, air compressors, generators, starters, etc. Write for Bargain Bulletin. Second hand auto accessories. Address Motor Sales, Dept. 14, West End, Pittsburgh, Pennsylvania.

**SALESMEN—Agents—Everywhere:** Sell "Tankit." Modern auto-fuel. Guaranteed: 100 to 200% profit. Every autoist interested. Exclusive territory. Tankit, Cleveland, Ohio.

**AUTOMOBILE Parts for all cars—50% off manufacturers' list price.** Pistons, connecting rods, cam shafts, crank shafts, cylinders, axles and gears. Our new catalogue and Used Parts Bulletin now ready. Write for it to-day. Service and satisfaction guaranteed. Auto Parts Company, 4108 Olive Street, St. Louis, Missouri.

**TIRES.** Factory-to-You Prices. Exclusive representative wanted each locality to use and sell Mellinger Extra Ply Tires. Guarantee Bond 8000 Miles. Sample sections furnished. Mellinger Tire Company, 937 Oak Street, Kansas City, Missouri.

**VULCANIZING** auto tires is a growing and profitable business. Easy to learn. Instruction book, \$1. Plants \$50 to \$300. Details free. Equipment Co., 17 Canal, Cincinnati, Ohio.

**HYDRONIZER:** Insures clean plugs, consumes carbon, saves gasoline, intensifies power and increases speed. For all cars. Money back guarantee. Big profits for agents. Free literature. Priestedt Manufacturing Company, 2933 West Lake Street, Chicago.

**PATENTS—Write for Free Illustrated Guide Book and Evidence of Conception Blank.** Send model or sketch and description of invention for our opinion of its patentable nature. Highest references. Reasonable terms. Victor J. Evans & Company, 189 Ninth, Washington, D. C.

**INSYDE Tyres.** Inner armor for Automobile Tires, prevents punctures and doubles mileage of any tires. Liberal profits. Details free. American Accessories Co., Dept. 97-A, Cincinnati, Ohio.

**RED DEVIL Auto Polish—Brightens the way.** Regular 60c. can, 50c to introduce. Agents wanted. Red Devil Products, Dept. 1, Farmingdale, New York.

**CHILDREN** can fix punctures with Kinsey's Electric Patch. Instantaneous—Permanent—Guaranteed. Mailed, prepaid for dollar bill. Kinsey Patch Company, Junction, City, Kansas.

**SHINELO—Unexcelled Auto Body Polish.** Formula, \$1.00. A top dressing formula free. John Eberle, West Water, Chillicothe, Ohio.

**MR. ADVERTISER:** Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

**VULCANIZERS—Our circular tells how to make blow-out patches from used tire fabric.** C. M. Anderson, Batavia, Illinois.

**BULL dog inner tires** molded to fit your casings. Practically eliminates blow-outs and punctures. Doubles the life of your tires. Wonderful seller and repeat order getter. Write for particulars to-day. Agents making \$5,000 to \$10,000 a year. Eastern Auto Specialty Co., Dept. B, Utica, New York.

**RACING body** at little cost, build it yourself. Send 50c for instructions and blueprint. F. Floege, Box 321, Nord Chicago, Illinois.

**BLUEPRINTS** of connections for armatures of automobile starters, generators, and motor-generators. See ad under "Electrical." Charles Chittenden.

**TIRES** at wholesale. We have the cheapest, high-grade, long life and reliable tires in the world. No "seconds" or rebuilt. Send for prices. Overton Tire Company, Oelwein, Iowa.

**BUILD your own garage.** Blueprints, instruction, list of material needed, \$2. Money refunded if not satisfactory. Al. Violett, 52 Park Street, Providence, Rhode Island.

## WELDING AND SOLDERING

**DON'T** scrap aluminum parts. Save them, with So-Luminum. New, great "3-in-1" welding, brazing and soldering compound, stronger than aluminum—perfect substitute for acetylene welding— $\frac{1}{2}$  time and cost. Use gasoline torch or soldering iron. No flux. Booklet 9. Sample bar \$1.00. Used by United States Army and Navy, endorsed by British Munitions Board. So-Luminum Manufacturing Company, 1790 Broadway, New York.

**WELDING PLANTS, \$25.00 to \$300.00.** Designed for all purposes. Small cash payment, balance three to six months. Every mechanic or shop should have one. Bermo Welding Co., Omaha, U. S. A.

**20TH Century Aluminum Welding Metal,** repairs anything in aluminum, used exclusively by several automobile manufacturers, garages, etc. Sample \$1.00; \$3.00 lb. Fully guaranteed. Chas. Mend, 1023 Holmes Street, Lansing, Michigan.

**SOLDERING paste** for soldering aluminum with ordinary solder works on thin sheets or large castings. \$1.00 a can. Wagner Supply Company, 134 South Burdick Street, Kalamazoo, Michigan.

## WIRELESS

**SIMPLE** Wireless Telephones and How to Make Them. A good book for the advanced radio amateur on the principles, construction and use of the wireless telephone. Price 25 cents postpaid. Book Dept., Popular Science Monthly, 225 West 39th Street, New York.

**"SILVERPLATE"** without electricity. Bottle "Silverplate" 35c. Roberts, 11/15 Detroit Avenue, Cleveland, Ohio.

## FORD ACCESSORIES

**FORD Speed-Power Equipment** stocked: 4 speeds forward auxiliary transmissions; double pulling power, increase speed 40 or 20%; 16 valve overhead cylinder head; speed carburetors; crankshaft counterbalances; high tension magnetos; underslung fixtures; speed power bevel gears; foot accelerators; steering wheels; wire wheels; disc wheels; metal wheel discs; Ford fire chemical hook and ladder; 13"-30" double universal wheelbase extension; 1-1 $\frac{1}{4}$  ton side spring additional frame worm unit; complete line 1-5 ton shaft-chain drive units; racing bodies; complete racing cars, \$500 to \$1,750. Special—Instantaneous Electric Hot Water Heater, attachable any faucet. Retail \$60. Dealers \$45. P. Ford Speed-Power Equipment Manufacturers, 250 West 54th Street, New York City.

**FORDS** run 34 miles per gallon with our 1920 carburetors. Use cheapest gasoline or half kerosene. Start easy any weather. Increased power. Styles for all motors. Runs slow in high gear. Attach yourself. Big profits for agents. Money back guarantee, 30 days' trial. Air-Friction Carburetor Company, 500 Madison Avenue, Dayton, Ohio.

## The Best Out of Forty

Popular Science Monthly,  
225 West 39th Street,  
New York City.

Gentlemen:

We advertise in more than forty publications, and keep a full record of each one. Your publication has paid us better than any other magazine we use. Not only do first returns cost less, but we get a larger percentage of second returns. A number of our best regular customers were introduced to us by Popular Science Monthly.

Very truly yours,

CHAMBERS PRINTING WORKS

If you would like to know what other advertisers think and say about "Quick Action Advertising" in Popular Science Monthly, ask us for the **REAL** proof. We have hundreds of letters from satisfied and successful advertisers in every part of America—men who have learned, by actual experience, that Popular Science Monthly **PAYS**. Their knowledge should be of special value to you in choosing a list of mediums for your advertising. Why not learn what they have to say, profit by their wisdom and spare yourself costly experimentation? Ask us today!

Classified Advertising Manager

POPULAR SCIENCE MONTHLY  
225 West 39th Street  
New York City

**FORDS** double the mileage with Picard Carburetors. Easy starting. Double the power. Satisfaction absolutely guaranteed. Free trial. Agents wanted. York Sales Company, Dept. P8, 1518 East Jefferson Avenue, Detroit, Michigan.

**TIMER** Brush. New wiping contact; quick starting; easiest running. Only 34 cents, prepaid. R. Sp. Works, Box 543, Riverside, California.

**SAVE-ALL** Carburetor Attachment makes Fords run better. Gives more miles, power and speed. Free trial. Savall Company, 3716 North Clark Street, Chicago.

**OUR Spark Intensifier** fires all four cylinders with cracked or worn out plugs, locates ignition troubles instantly and makes your car start easier. Send one dollar for sample and liberal agents proposition. Cynthia Company, Box 476, Seattle, Washington.

**FOUR Dollars** insures you for life against being kicked by your Ford. Write to-day for our free booklet "Kant-Kiek", the safety device for Fords. Easily attached. Buffum Tool Company, Louisiana, Missouri.

**"SURE-HIT Timers,"** \$4.00. Something different and guaranteed in writing for two years when used with the L. W. Juice Plug, \$3.50. (Not a spark plug.) Both sent prepaid for \$7.00. If not more than satisfied with results, we will cheerfully refund your money. Omaha Accessory Company, 1018 Douglas Street, Omaha, Nebraska.

## MOTORCYCLES, BICYCLES, SUPPLIES

**MOTORCYCLES** all makes, \$25.00 up. New bicycles at big reduction. Second hand, \$8.00 up. Motors, motor attachments, cycle motors, Smith motor wheels, etc., \$20.00 up. New parts to fit all makes carried in stock. Second hand parts good as new 50% discount. Expert repairing, on magnetos, generators, transmissions. Motors overhauled \$10.00 up. Henderson motors our specialty. Write for big bargain bulletin. American Motor Cycle Company, Dept. 3, Chicago.

**REBUILT** motorcycles at half cost of new machines. Write for spring bulletin. Western Supplies Company, 371 Hayutin Building, Denver, Colorado.

**\$25.00 Up—Guaranteed rebuilt motorcycles—Henderson, Excelsior, Indian, Harley-Davidson.** Bicycles, \$5.00 up. Tires and accessories at wholesale. Illustrated bulletin "A" free. Ash Motor Corporation, 162 North Clinton Avenue, Rochester, New York.

**USED Motorcycle Bargains:** Indiana, Excelsiors, Harleys, \$40.00 up. Singles or twins. Overhauled, rebuilt and tested by experts. Shipped on approval and guaranteed. Send stamp for Big Free List. We furnish bank references. Floyd Clymer, Desk A, "Largest Motorcycle Dealer in Western America," Denver, Colorado.

**REBUILT** Motorcycles—New 1920 Spring list; Harley-Davidsons, Indians, Excelsiors, Hendersons, and sidecars \$50.00 to \$375.00. Every machine rebuilt and guaranteed as represented. Write for new folder B. Carl W. Bush Co., 519 Broad St., Newark, New Jersey.

**LATEST "Rogers Side Cars,"** complete all colors with extension axle fit any motorcycle, while this new stock lasts, prepaid first 1,000 miles, \$110. Used and rebuilt motorcycles, side cars, vans, \$25.00 up; engines, \$15.00 up. Full presto tanks, fittings, complete, \$7.00; other bargains. State your requirements. Enclose stamp. Erickson, 8039 Parnell Avenue, Chicago.

**SMITH Wheel Auto,** only \$65. Fine condition. V. Tege, Haddonfield, New Jersey.

**MR. ADVERTISER:** Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

## MANUFACTURING

**WE** do Metal Stamping, Die and Model Work, Gold, Silver, Nickel, Copper and Brass Plating; also special finishes. We will manufacture your article either on straight time or contract basis. When our tool or model maker is on your job, you are welcome at his bench. Denning Manufacturing Company, 1775-1777 East 87th Street, Cleveland, Ohio.

**TO Order:** Any article in metal; models, tools, patterns, experimenting, manufacturing, inventions developed. Cleveland Specialty and Manufacturing Company, Cleveland, Ohio.

**CENTRAL Machine Works, St. Louis, Missouri.** Special Machinery builders manufacturing in any quantities, dies, tools, battery moulds, stampings and parts.

## AVIATION

**"FORD"** motored tractor biplane. You can build your own. We tell how to remodel motor and include full size drawings of metal parts and wing curve with our plans and instructions. All for \$2.50. Consultation with aeronautical engineer free to builders. Ready made parts at reasonable prices. Circular on request. Aviation Directory, Lawrence, Kansas.

**COMPLETE** set of drawings of the Liberty 12 Engine. A United States Standardized Aircraft Engine. Giving all views with number of parts, names of parts and weights of parts. Mail \$1.00. Dept. E, Ocean Publishing Company, 25 West 42d Street, New York City.

**THE American School of Aviation** announces a new correspondence course in Mechanics of Aviation. A thorough training in practical aeronautics. American School of Aviation, Dept. 188A, 431 South Dearborn Street, Chicago.

**HEATH Airplane Co.'s Catalog "N"** is the most complete booklet ever published on aeronautical needs. 12c in stamps. Get our pamphlet on Ford and Motorcycle engine-driven airplanes, 4c; also glider circular, 4c. We buy and sell all kinds of aeronautical motors. Heath Airplane Co., Chicago.

**INVENTORS** desiring information write for our Free Illustrated Guide Book and Evidence of Conception Blank. Send model or sketch of invention for our opinion of its patentable nature. Highest references. Prompt service. Reasonable terms. Victor J. Evans & Company, 151 Ninth, Washington, D. C.

**AERONAUTICAL** engineer. Expert advice, designs, reports, tests. Motors a specialty. Adrian Van Muffing, City College, New York.

**BUILD** the Simmons Biplane, price list, drawings and building instructions, \$1.00. Particulars free. Simmons & Lawrence, Fairfield, Illinois.

**AIRPLANES—1 to 6 passenger;** aeronautical motors 30 to 300 HP. Lowest prices. State your needs. Send for lists "P. S." Aero Exchange, 38 Park Row, New York.

## TRADE SCHOOLS

**COME** to a Real School. Learn Sign, Seende and Auto Painting — Paperhanging — Decorating — Showcard Writing. Catalogue Free. Chicago Painting Schools, 129 North Wells Street, Chicago.

## FOR BOYS

**SEE** page 146. Have you a Saw and a Hammer?

**HERE** Boys! Read Nifty Toy Company's ad on page 146.



## MOTORS, ENGINES, MACHINERY

**SMALL Motors and Generators.** Cancelled Government Contracts A. C. Motors \$9.50 each and up. 12 Light 110 volt Generators \$26 each. Battery Charging outfits \$30 each and up. New Motors 1/4-1/2 up to 5 HP for all phases and frequencies of current. Write for late Bulletin. Bargains in Motors and Generators. Address: Motor Sales, Dept. 14, West End, Pittsburgh, Pennsylvania.

## ELECTRICAL

**BLUEPRINTS**—Electrical connections. 236 A. C. motor, single, two, and three phases. Voltage, cycle, phase, speed changing. 123 D. C. Voltage changing, etc. 120 transformer connections. 172 rheostats, controllers, compensators, both internal and external connections. 175 diagrams covering 250 armatures for automobile starters, generators, and motor-generators, with complete rewinding data. 10 samples A. C. connections, 25c. Particulars free. Charles Chittenden, Dept. 8, 3024 Matthews Avenue, Kansas City, Missouri.

**ELECTRICIANS, Wiremen, Linemen,** send your name and address for descriptive literature of our Modern Blue Print Chart Method of Electrical Wiring. Over 350 practical diagrams. Electrical Wiring Diagram Company, Box B173, Altoona, Pennsylvania.

**SELENIUM CELLS**—Made by entirely new process. Highly sensitive and quick-setting. Suitable for all experiments. From \$5 up. Write for Catalog. Selenium Laboratories, Good Ground, Long Island, New York.

**100 Induction Motor Winding Diagrams 1, 2 and 3 Phase, Star, Delta, 1 to 12 Poles Inclusive.** Postpaid \$5.00. E. Glass, 2819 East Eighth Street, Kansas City, Missouri.

**MAKE Dry Batteries.** Simple, practical instructions, with blue print, 25 cents. Dirigo Sales Company, Bath, Maine.

**ELECTRIC Telephones, 2 receivers, 2 transmitters,** complete with diagrams, \$1.00. Inland Specialty Company, 1580 North Robey Street, Chicago.

## WANTED

**CASH for Old False Teeth.** We pay up to \$35.00 per set (broken or not). Also buy discarded gold jewelry, gold crowns, bridges, platinum, diamonds, watches and silver. Send now. Cash by return mail. Package held 5 to 10 days for senders' approval of our offer. U. S. Smelting Works, Dept. 81, Chicago, Illinois.

**WANTED**—Small gasoline and steam engines. Drill presses, lathes, electric motors, etc. Will pay high cash prices for good material. Johnston, West End, Pittsburgh, Pennsylvania.

**WANTED**—Representatives in every factory in the United States. Popular Science Monthly, 225 West 39th Street, New York.

**WE pay the highest prices for diamonds, platinum, watches, old or broken jewelry, old gold, silver, magneto points, old false teeth, gold or silver ores or nuggets.** War Bonds and Stamps. Mail them to us today. Cash by return mail. Goods returned in 10 days if you're not satisfied. The Ohio Smelting & Refining Company, 238 Lennox Building, Cleveland, Ohio.

**DEALERS** to carry stock of guaranteed roof paint and cement, stops leaks quickly, permanently; ready for use; no thinning; does not settle; we advertise for you. Martinek Company, Dept. "J," 405 Lexington Avenue, New York City.

## KEY DUPLICATING MACHINES

**DUPLICATE keys for all Yale and similar locks made in one minute with Harrison Key Filing Machine.** No misfits. Thousands in use. Sent prepaid \$5.00. Money returned if not satisfactory. Harrison & Company, 83 New Street, New York.

## DUPLICATING DEVICES

**"MODERN" Duplicator**—A Business Getter, \$1.50 up. 50 to 75 copies from pen, pencil, typewriter; no glue or gelatine. 35,000 firms use it. 30 days' trial. You need one. Booklet Free. J. V. Durkin & Reeves Company, Pittsburgh, Pennsylvania.

## FOR SALE AND EXCHANGE

**CHOICE silver black breeding foxes.** Instructions. Reid Brothers, Bethwell, Ontario.

**MR. ADVERTISER:** Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

**MECHANICAL drawing instrument outfits at special bargains,** send for our catalogue. National Instrument Company, Box 1707, Denver, Colorado.

**LET'S swap!** What've you got? What d'ye want? Three months, dime, "The National Exchange Medium," Detroit.

## FOR THE HOME

**GRANDFATHER'S Clock Works \$5.00.** Build your own cases from our free instructions. Everybody wants a hall clock. You can make good profit building artistic clocks for your friends. We replace worn-out works in old clocks with works having ciphers at money saving prices. Write for folder describing the most beautiful hall clock ever sold at \$25.00. Clock Co., Neshotown, Pennsylvania.

**OUR Leather Preservative** doubles the life of your shoes or any leather goods. Sample and booklet 35c. Belgian Specialty House, 2806 Union Avenue, Chicago.

**CLEAN your wall paper,** it's easy to do. New process, simple method, no experience or apparatus required. Complete instructions, one dollar. James T. Herr, Dept. D, 2919 West North Avenue, Baltimore, Maryland.

## LABORATORY AND CHEMICAL

**EXPERIMENTAL laboratories, \$11.00 to \$100.00.** Payment plan or cash. Actual photographs free. Write Dept. 8-27. Lions Scientific Institute, "Laboratory Outfitters," Mt. Oliver, Pittsburgh, Pennsylvania.

## PRINTING, ENGRAVING, MULTIGRAPHING

**GOOD Printing at low prices.** 1,000 good letterheads, envelopes, cards, billheads, labels, circulars, \$2.50; samples free; catalogues, booklets and circulars our specialty. Ernest F. Fantus Co., 523 S. Dearborn St., Chicago, Ill.

**MULTIGRAPH Letters** build business. Most economical and effective advertising. Printing. Addressing. Low rates; careful work; service. Multigraph-Peoples Letter Company, 241 Fourth Avenue, New York.

**"ACTUAL" Typewritten Letters,** heading, printer's type, black; body, purple, blue or black typewriter type, 100, \$2.75; 500, \$5.50; 5000, \$17.50. Artus Letter Shop, 409 Chestnut Street, Milwaukee, Wisconsin.

**5000 Gummed Labels, \$1.50.** Catalog. Irwin Wolf, Station E, Philadelphia.

**100 Cards, business, professional or social,** also imitation leather card case, for 60 cents. M. F. Devaney. Printing, Engraving, Rubber Stamps, 31 Middle Street, Geneva, New York.

**MR. ADVERTISER:** Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

**250 BOND LETTERHEADS, and Envelopes, \$2.25.** Other printing, lowest prices. Samples, 4c. B. F. Ball and Company, Dept. 26A, Buckland, Connecticut.

**LETTERHEADS \$2.50 thousand.** Samples free. Quality Print Shop, Marietta, Ohio.

**BUSINESS and Name Card specimen sheets on request.** Star Press, Box M37, Winchester, New Hampshire.

**1,000 LETTERHEADS, envelopes, cards, etc., \$3.00 and less.** P. S. Orvis, Hackensack, New Jersey.

**PRINTING**—Quick service! Bond letter heads, bill heads, statements, envelopes, cards, etc., 1,000, \$4.00; 5,000, \$15.00. Automatic presses insure quick deliveries. Federal Printing Company, Baltimore, Maryland.

**GOOD printing quick—at lowest prices.** Samples free. Bamberg Printing Company, 2245 South Kedzie, Chicago.

## FORMULAS

**TO manufacture products that bring repeat orders,** you need dependable formulas as a foundation. We supply guaranteed formulas for such specialties as soldering alloy for aluminum; paint and varnish remover; fire extinguishing compound (dry form); solidified alcohol (for healing); non-inflammable metal polish, \$1.00 each. Lists, 2c. Industrial Methods Bureau, 118 West 34th Street, New York.

**500 Formulas—Trade wrinkles, secrets, discoveries.** All easy, successful money-makers. Everything, 25c. Edgar James, 315 Douglas, Indianapolis, Indiana.

**PROFITABLE money-making processes.** Details of manufacture accompanying each formula. Send for list. F. N. Beardslee, 1468 Broadway, New York.

**500 successful money-making formulas and trade secrets.** Postpaid, 25c. Charles Dines, Winchester, Indiana.

**GUARANTEED Formulas**—Rubber tire cement—auto polish—puncture plugger—soldering paste—resilvering mirrors—luminous paint—mechanics soap—renewing dry batteries—20c each. Entire collection 50c. Formula catalog free. S. & H. Manufacturing Laboratories, 15602 Boylston Building, Chicago.

**SELF-SHINING shoe polish formula, 25c.** Al. Tytler, Monterey, California.

**FORMULA**—Powder to make ice in summer. Freeze water solid, \$1.00. Formula—Inexpensive substitute for butter. Absolutely pure, \$1.00. Formula—Egg Dip. Keeps eggs strictly fresh indefinitely, \$1.00. 20,000 honest, high-class, workable formulas including all of above \$3.00. Nearly all new. Free assistance in starting business. Money refunded if not satisfied. C. J. Callender, Square Deal Mail-Order Man, 3237 Garfield, Kansas City, Missouri.

## ADVERTISING SERVICE

**1000 Advertising Headlines and Showcard Suggestions.** Inspiration for advertisers. Mailed on receipt of 50c. Money back if you return book. Richards School of Advertising, 4305 Cottage Grove, Chicago.

**SPECIAL! 1,000 co-publishers wanted!** Sample-Publication-Registration, \$1. Globe Syndicate, Atlantic City.

**SPECIAL! Whole Page Display advertisement 150 Magazines** Thrice \$150. Popular Globe Syndicate, Atlantic City.

## LETTER SPECIALISTS

**WHOLESALE, Human, Persuasive Sales Letters: free folder.** Friend Cook, 103P Park Avenue, New York.

**MR. Business Man—Mail-Order Letters that have "pull," and "produce."** I write. Camille Plumer, 1121 South Main, Waterbury, Connecticut.

## MAILING LISTS

**5,000 different classifications, 1919-1920.** Largely \$2.00 per thousand addresses. Rightquick Publicity Bureau, 1314 Arch Street, Philadelphia, Pennsylvania. Established 1907.

## GUMMED LABELS

**PAYNE "Stick-Tight" Gummed Labels—used the world over.** Payne-Standard Company, Box 121-K, Passaic, New Jersey.

## OFFICE AND FACTORY EQUIPMENT

**ADDRESSOGRAPHS, Multigraphs, Folders, Sealers,** duplicators bought and sold. Office Device Company, 154A West Randolph, Chicago.

**"ALL-IN-ONE" System—Revolutionizes Bookkeeping.** John Capehart, Russellville, Kentucky.

**MULTIGRAPHS, Addressographs, Duplicators, Sealers,** Folders, less than half price. Guaranteed one year. Fruit Company, 112-M North La Salle, Chicago.

## AMERICAN MADE TOYS

**WE Offer an opportunity to manufacturers with facilities** for large production, also to homeworkers on smaller scale, to manufacture Metal Toys and Novelties. Unlimited field and enormous business open for ambitious people. No experience required. No tools needed. Our casting-forms turn out goods complete. Since the different Toy Expositions, manufacturers are covered with orders until December. You can enter this field now, by manufacturing "American Made Toys." We furnish casting-forms for Toy Soldiers, Army, Navy, Marine, Cannons, Machine Guns, Indians, Cowboys, Warships and other novelties. Casting-forms complete outfit \$3.00 up. We buy these goods, direct from manufacturers. Yearly contract orders placed with reliable parties. We pay very high prices for clean painted goods. Samples furnished. "Bird-Whistler" great seller, just added to our stock list. Booklet, information, instruction free, if you mean work and business. No others invited to write. Toy Soldier Manufacturing Company, 32 Union Square, New York.

## ADDING MACHINES

**WONDERFUL Adding Machine, seven columns capacity,** only one dollar. Adds and multiplies as fast as the fingers will move. Thousands being sold through demonstration. L. J. Leshman Company, Dept. L, Ogden, Utah.

**MARVELOUS new Automatic Adding Machine.** Retail \$12.50. Work equals \$300 machine. Five-year guarantee. Write for trial offer. Calculator Corporation, Dept. P, Grand Rapids, Michigan.

## TYPEWRITERS AND SUPPLIES

**NEW, remanufactured and slightly used Typewriters \$8.00 up.** Portable Machines \$10 up. Write for our Catalog 25F. Seran Typewriter Company, 58 West Washington Street, Chicago.

**GOOD typewriter for sale, cheap.** Walter P. Smith, Crescent, Iowa.

## MISCELLANEOUS

**MACHINISTS.** Send 25c today for working drawing of a new adjustable boring tool. Just what you need. G. P. Markett, 49 Vannem Avenue, Springfield, Massachusetts.

**ELECTRICAL Tattooing Machine, \$3, \$5, and \$7.** Catalogue for stamps. J. H. Temake, 1019 Vine, Psm., Cincinnati, Ohio.

**HAIRNESS.** Indian's recipe for growing hair: astonishing success. Proof box mailed for 10 cents. John Hart Brittain, 150 East 32nd Street, BA-188, New York.

## TELEGRAPHY

**TELEGRAPHY (both Morse and Wireless) and railway accounting,** taught thoroughly and quickly. Big salaries now paid. Great opportunities. Oldest and Largest School. Established 45 years. Catalog free. Dodge Institute, 2nd Street, Valparaiso, Indiana.

## MODELS AND MODEL SUPPLIES

**INVENTORS** before ordering your models or having machine work done, ask for our illustrated booklet. Central Machine Works, St. Louis, Missouri.

**PATENTS**—Book free. Send sketch for free opinion of patentable nature. Talbert & Talbert, 4948 Talbert Building, Washington, D. C.

## PAINTS, VARNISHES, SUPPLIES

**ROOF leaks stopped quickly, permanently; product guaranteed; comes ready for use; thinning unnecessary; does not settle; exclusive territory with free advertising to dependable dealers considered.** Martinek Company, Dept. G, 405 Lexington Avenue, New York City.

## BLUEPRINTS

**BLUEPRINTS:** Learn Blueprint Reading from 33 Large Blueprints. It matters not what line you are in. We show you how. It's easy. It's job insurance. Get our circular or send \$1. We will mail you first four Blueprints. If satisfactory, order balance. Charles J. H. Freeth, Consulting Chief Draftsman, Mechanical Improvement Association, Dept. 25, 1628 West Lehigh Avenue, Philadelphia, Pennsylvania.

## FOREIGN LANGUAGE STUDY

**SPANISH language easily learned at home.** Weekly private correspondence lessons. Only \$6.00 monthly. 17th successful year. Fradera Studios of Spanish, 180 Broadway, New York.

## AUCTIONEERS

**AUCTIONEERS—Make big money.** Free catalogue. Carpenter's Auction School, Kansas City.

## DIAMONDS, WATCHES, JEWELRY

**CASH—Send by mail or express any discarded jewelry,** diamonds, watches, old gold, silver platinum, magneto points, false teeth or bridgework. Nothing too small or large. We send cash immediately and hold your goods, to be returned at our expense if our offer is unsatisfactory. Bank references. Yonover Brothers, 1637-S Roosevelt Road, Chicago.

## DOGS, BIRDS, PETS

**BREED Canaries—Profitable pastime.** Particulars free. Bird Farm, Lynnhaven, Virginia.

## FISH, AQUARIUMS, SUPPLIES

**GOLDFISH—Imported Japanese, Chinese and American fish;** aquarium plants, artistic, durable aquariums. Catalogue. Pioneer Goldfish Hatchery No. 5, Racine, Wisconsin.



## PHOTOGRAPHY AND SUPPLIES

MAIL us 20c with any size film for development and six velvet prints. Or send six negatives any size and 20c for six prints. Or send 40c for one 8 x 10 mounted enlargement. Prompt, perfect service. Roanoke Photo Finishing Company, 212 Bell Avenue, Roanoke, Virginia.

FILMS developed 5c roll, prints 3c each. Photo Service, 929 McMillan, Cincinnati, Ohio.

CAMERAS—Films, supplies, at reduced prices. Films developed 2c, prints 2c up. Write for free catalog. Pearl Photo Place, 640 East Clementine Street, Philadelphia, Pennsylvania.

SOMETHING different! Polished silver-tone prints; six, 20c.; send roll or negatives. "Silver-tone," 950-A Lockwood, Chicago.

KODAK'S Notice: The New Short Process of Developing and Printing will prevent many disappointments with your Kodak Pictures. Send a roll for a trial order. Guaranteed Work. J. F. Short Company, King Street, Charleston, South Carolina.

DISABLED Soldiers Photo Company, 3654 North Halsted Street, Chicago. Films developed, 7c; prints, 3c; each. Give us a trial.

MR. ADVERTISER: Ask to-day for a copy of the "Quick Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

## MOTION PICTURE BUSINESS

\$35.00 profit nightly! Small capital starts you. No experience needed. Our machines are used and endorsed by government institutions. Catalog Free. Atlas Moving Picture Co., 441 Morton Building, Chicago.

WRITE Photoplays; \$50 each. Experience unnecessary; details free to beginners. Producers' League, 194, St. Louis.

PHOTOPLAYS Wanted. Big prices paid. You can write them. We show you how. Free particulars. Rex Publishers, Box 175, F 25, Chicago.

MAKE money fast. Small capital buys professional machine and complete outfit. Easy payments. No experience required. Openings everywhere. Catalog free. Dept. 535, Monarch Theater Supply Co. Address nearest office: Ellsworth Building, Chicago; 420 Market, St. Louis, Missouri; 228 Union, Memphis, Tennessee.

LEARN how to write photo plays. My book tells how, where to send, gives model, for 50c. Lester deFries, Box 1416, Boston.

MAKE money fast; small capital starts you with guaranteed professional moving picture machine. Complete outfit on easy payments. No experience needed. Catalogue free. Monarch Theater Supply Service, 433 Market Street, St. Louis, Missouri.

EARN big money writing photoplays. Outline free. Los Angeles Photoplay Company, Los Angeles, California.

## AUTHORS—MANUSCRIPTS

FREE to Writers—A wonderful little book of money-making hints, suggestions, ideas; the A B C of successful story and play-writing. Absolutely Free. Just address: Authors' Press, Dept. 15, Auburn, New York.

WRITE for newspapers and magazines. Big Pay. Experience unnecessary, details free. Press Reporting Syndicate, 400, St. Louis.

WRITERS: Have you a song-poem, story, photoplay, to sell? Submit manuscript now to Music Sales Company, 48, St. Louis.

WRITERS: Stories, poems, plays, etc., are wanted for publication. Literary Bureau, 117, Hannibal, Missouri.

IF You Will Write The words for a song, I will write the music and guarantee publisher's acceptance. Poems on any subject acceptable. Ethel Hanson, Room 137, 3808 Broadway, Chicago, Illinois.

## MUSIC AND SHEET MUSIC

MUSIC—Learn by mail—Graphic Drawings System—Three Lessons comprising Theory, Time, Measure, Chords, start you playing easy tunes. Piano, Violin, Flute, Banjo, kindred instruments. Singing. Single lesson \$1.00, Set \$2.00. Technon Schools, 128 West 104th Street, New York.

IF you appreciate good music, turn to the "Puss-in-Boots" announcement on page 184. Agents wanted too.

WRITE the words for a song. We write music, guarantee publisher's acceptance. Submit poems on patriotism, love or any subject. Chester Music Company, 920 South Michigan Avenue, Room 111, Chicago.

WRITE the words for a song. We revise poems, write music and guarantee to secure publication. Submit poems on any subject. Broadway Studios, 121C Fitzgerald Building, New York.

WRITE a Song—Love, mother, home, childhood, patriotic or any subject. I compose music and guarantee publication. Send words to-day. Thomas Merlin, 238 Resper Block, Chicago.

YOU write words for a song—we write the music, publish, and secure a copyright. Submit poems on any subject. The Metropolitan Studios, 914 South Michigan Avenue, Room 105, Chicago, Illinois.

SONG-WRITERS' Manual and Guide Sent Free. Contains valuable instructions and advice. Submit song-poems for examination. We will furnish music, copyright and facilitate publication or sale. Knickerbocker Studios, 315 Gaiety Building, New York.

YOU WRITE THE WORDS FOR A SONG—We'll compose the music free and publish same. Send Song Poem today. A. G. Lenox Co., 101 West 42nd Street, New York.

## MUSICAL INSTRUMENTS

CORNETISTS—Trombonists: "Free Pointers" on weak lip—high tones. Virtuoso Cornet School, Buffalo, New York.

WONDERFUL discovery. Make your violin talk. Yes, I mean actually speak words, sing, laugh. \$1.00 for the secret. Particulars free. A. Warren, Fairfield, Illinois.

MUSICIANS delight! Music stand and automatic leaf-turner combined. Booklet free. Olsen & Anderson, 1717 Third Avenue, New York City.

## EDUCATIONAL AND INSTRUCTION

BUSINESS Letter Writing Taught in Ten Lessons. Here is your chance to learn to write letters that rivet the sale, collect money, make adjustments and handle big transactions. Learn the fundamental principles and write convincing letters. This ability will give satisfaction and increase your income. Each Lesson contains full explanation, numerous model letters and practical exercises. Special Offer! \$2.00 for Complete Volume, Ten Lessons, \$2.00. Puffer & Walsh, 120 Greenfield Street, Buffalo, New York.

EARN \$75.00 to \$100.00 per week. Write for full information concerning my course in Commercial Art, Designing and Show-Card Writing. Pay and earn while you learn. Oelwein Art Studio, Oelwein, Iowa.

"STENO-SCRIPT" takes dictations, lectures, speeches, 200-300 words minute. Wonderfully simple! Learned in few hours. Introductory offer, 55c. "Steno-Script," Tacoma, Washington.

LINCOLN-JEFFERSON University. Home Study in college. Theology, Law, Music, Business and Graduate schools. Usual degrees granted. Lock Box 239G, Chicago.

DOUBLE-ENTRY Bookkeeping mastered with 8 Keys in 60 hours; guaranteed; diplomas; twenty lessons \$5. International Bookkeeping Institute, Springfield, Missouri.

CARTOONING, Comics and Lettering in fourteen easy lessons, only \$5 postpaid. Over 300 illustrations. Sample lesson free. Ernie's School, Elyria, Ohio.

## PICTURES AND POSTCARDS

JOIN Live Postcard Club. Membership Papers 10c. Harvey Teeple, Decatur, Indiana.

BOYS and girls—Join the Western Post Card Club. P. S. Fleming, Mgr., Box 82, Elk, Washington.

EVERYTHING in Post Cards. Samples free. National, Box 208, Newark, N. J.

SPECIAL—Twenty clever, classy, assorted postcards, 10c prepaid. Swanson, 12058 Kansas Avenue, Kansas City, Kansas.

## GAMES AND ENTERTAINMENT

PLAYS, vaudeville acts, monologs, dialogues, recitations, pageants, musical readings, special entertainments, tableaux, drills, minstrel jokes, make-up goods. Large Catalog Free. T. S. Denison & Company, Dept. 26, Chicago.

TRICKS and Greenbacks. Big magic catalog 5c. Twenty greenbacks—10c. Gilmagico, 11135 South Irving, Chicago.

CRYSTAL Gazing—the craze: send self-addressed stamped envelope for free instructions. Zancigs Studio, Asbury Park, New Jersey.

FREE! Latest Illustrated Catalog Pocket Tricks. Jokes, Puzzles, Books and Imported Novelties. Large Low Priced Line. "10 Select Card Tricks" included, 6c. Send to-day! Lyle Douglas, Sta. A-5, Dallas, Texas.

DRIPPING Cigarette—Good pocket trick. Roy Foadick, 217 Shelton, Jamaica, New York.

150 Parodies on latest songs 10c. Charles Dynes, Winchester, Indiana.

OVER the Top puzzle and wholesale joke. Catalogue, 10 cents. Mears, 66, Anderson, Indiana.

BOYS—Bet your baseball cranks they can't spell baseball with this new baseball puzzle. Mystifies young and old. Prepaid, 25 cents. Baseball novelties. P.O. Box 246, Plainfield, New Jersey.

## CANDY

CHERI Super Chocolates, assorted, pound box \$1.25, parcel post prepaid, insured. Best you ever tasted at any price or the box with our compliments. Cheri, Inc., 142 South 15th Street, Philadelphia.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

## ROOTS, HERBS, PLANTS

GATHER Ginseng, \$15. Belladonna \$65 per lb., or grow them yourself; 200 seeds each with instructions only \$1. O. Twitchell, West Milan, New Hampshire.

## STAMMERING

STAMMERING cured—quickly, permanently, and privately. Write for free booklet. Samuel E. Robbins, 246 Huntington Avenue, Boston, 17, Massachusetts.

ST-TUT-T-T-TERING and Stammering cured at home. Instructive book free. Walter McDonnell, 59 Potomac Bank Building, Washington, D. C.

## PHONOGRAPHS, RECORDS, NEEDLES

BUILD your own phonograph. Big saving. Pleasant, instructive work. Complete instructions, blue-prints, etc., absolutely free. Write to-day. Associated Phonograph Company, Dept. F1, Cincinnati, Ohio.

BUILD your Phonograph. "Perfection" high quality spring and electric Motors. Tone Arms, Reproducers. Wonderful results. Big saving. New catalog and building instructions mailed for ten cents. Indiana Phonograph Supply Co., Indianapolis, Indiana.

## MANUFACTURERS' AGENTS

RESPONSIBLE Sales Organization open to represent reliable manufacturers in New York on a commission basis. International Mercantile Sales Company, 110 West 40th Street, New York.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

## REAL ESTATE—FARMLANDS

OWN Your Own Orange Grove in Fruitland Park, Florida's finest lake-jeweled highland section, way above sea level. A few dollars a month will buy it. Plant peaches, a quick money crop, with oranges, and the peaches may be made to pay not only for your land and orange grove but yield a profit besides. We can produce you a better orange grove for less money than anyone in the State and in Florida's greatest section. Fruitland Park is best. We can prove it. Write for a book of actual photographs, the interesting story of a Fruitland Park farm and why peaches may pay for it. Lake County Land Owners' Association, 205 Palm Ave., Fruitland Park, Lake County, Florida.

SHAWNEE, Oklahoma, a growing city, a good place to live. Write for information, Board of Commerce, Shawnee, Oklahoma.

HARDWOOD land in Michigan makes you rich. 10 to 80 acres; \$15 to \$35 per acre. Grains, poultry, fruit or truck. Easy payments. Best land offer in U. S. Booklet free. Swigart Land Company, 01251 First National Bank Building, Chicago, Illinois.

MONEY-MAKING Farms—17 States—\$10 to \$100 acre. Stock, tools, crops often included to settle quickly. Write for big illustrated catalogue. E. A. Strout Farm Agency, 2026 BIL Sun Building, New York.

## FOR MEN AND WOMEN

MAKE your own dandruff remedy and hair tonic. Caspeline destroys dandruff and prevents it by removing the cause; freshens your scalp and beautifies the hair. One ounce in one pint of water does it. Do not pay fancy prices for plain remedies. One ounce sent prepaid on receipt of one dollar. Money gladly refunded if results are not satisfactory. World Chemical Corporation, 448 West Broadway, New York.

WOODEN CARDS—Very interesting. 25 printed in your name 25c. X-Ray Optical Puzzle, 10c. Hough Company, Box 1013, Lowville, New York.

GENUINE Indian Baskets—Wholesale. Catalogue. Gihman, Highland Spring, California.

"SEXUAL Philosophy," 12c. Clear, specific, authoritative, complete, best, satisfies. Fred B. Kaessmann, Lawrence, Mass.

MAKE \$19.00 Hundred Stamping Names on Key checks. Send 25c for sample and instructions. PS Keytag Company, Cohoes, New York.

BLUEPRINTS: How to read. See page 9. Mechanics' Improvement Association.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

MEN. Intensely interesting booklet free. Wonderful results. Winslow E. Chase, Washington, D. C.

COLD-PROOF your head! Insure your nostrils and throat against catching cold by simply syringing same at intervals (through an atomizer) with a solution of "Ozeno" Antiseptic Powder, 30c bottle, at druggists or direct from The Ozeno Company, 240 Broadway, New York City. (State and foreign agencies available.)

DETECTIVES—Great demand, excellent opportunity. Experience unnecessary. Write American Detective System, 1968 Broadway, New York.

SHAMPU-TABS: Three Suddy Shampoos, 15c.; 2 for 25c. Tab Products, Dept. 1, Farmingdale, New York.

MEN or Women—Enormous Profits Selling Duo Guaranteed Products. Easy sales at every house. All or spare time. Outfit free. Write quick. Duo Company, Dept. H66, Attica, New York.

BE a detective. Excellent opportunity, good pay, travel. Write C. T. Ludwig, 424 Westover Bldg., Kansas City, Mo.

"HEALTH-CULTURE"—insures vital force, youthful vigor, strength and beauty, 25c. "Natural Laws Governing Success"—158 pages, \$1.00. Five dozen "Money Makers," 30c. Professor Anderson, PM1336 Mores, Chicago.

"FORTY Ways to Make Money" 20 for Ladies—20 for Men. And "How to Write Scenarios." All for \$1. Reinhardt System, 747 East Jefferson St., Los Angeles, California.

CANDY—How to make it for pleasure or profit, 25 cents; descriptive circular free. Acme Supply House, 409 Chestnut Street, Milwaukee, Wisconsin.

## BOOKS AND PERIODICALS

"CONCORDIA" contains essays, short stories, current events, formulas, plans. Two years' subscription, 50 cents; one, 25 cents. Concordia Magazine, 11 Water, York, Pennsylvania.

BOOKS, Science, Literature, etc. Lists. Higene's, K2441 Post Street, San Francisco.

INSTRUCTION Book (for shop use) on Vulcanizing Auto-Tires, \$1. Tire Equipment Company, 19 Canal, Cincinnati, Ohio.

SIMPLE Wireless Telephones and How to Make Them. A good book for the advanced radio amateur on the principles, construction and use of the wireless telephone. Price 25 cents postpaid. Book Dept., Popular Science Monthly, 225 West 39th Street, New York.

BLUEPRINTS: How to read. See page 9. Mechanics' Improvement Association.

100,000 USED books for sale, 35c up. Some cost \$10.00 new; History, Scientific, Technical, Science, etc. Catalogues 10c. McCarthy, 1061 West Van Buren Street, Chicago, Illinois.

"HANDY Atlas of the World." Separate maps of the various states of the United States, all the continents and countries of the world. 75 pages of maps with valuable statistical data. Price postpaid \$1.00. Book Department, Popular Science Monthly, No. 225 West 39th Street, New York.

MECHANICAL, scientific books covering every trade. Also business. 6c stamps for complete catalogues appreciated. Satisfaction guaranteed. Howard Company, Dept. 86, 702 West 181st Street, New York City.

## PATENTS FOR SALE

WE have a few practical money-making inventions for sale or trade. Adam Fisher Mfg. Co., 183B, St. Louis, Missouri.

PATENTED folding adjustable hinge for use on all makes of ceiling fans. Sell patent or royalty. See picture in this issue. A. W. Tucka, care Hotel Tulsa, Tulsa, Oklahoma.

CAPITALIST wanting share in good invention, write Arthur McNeil, Baraga, Michigan.

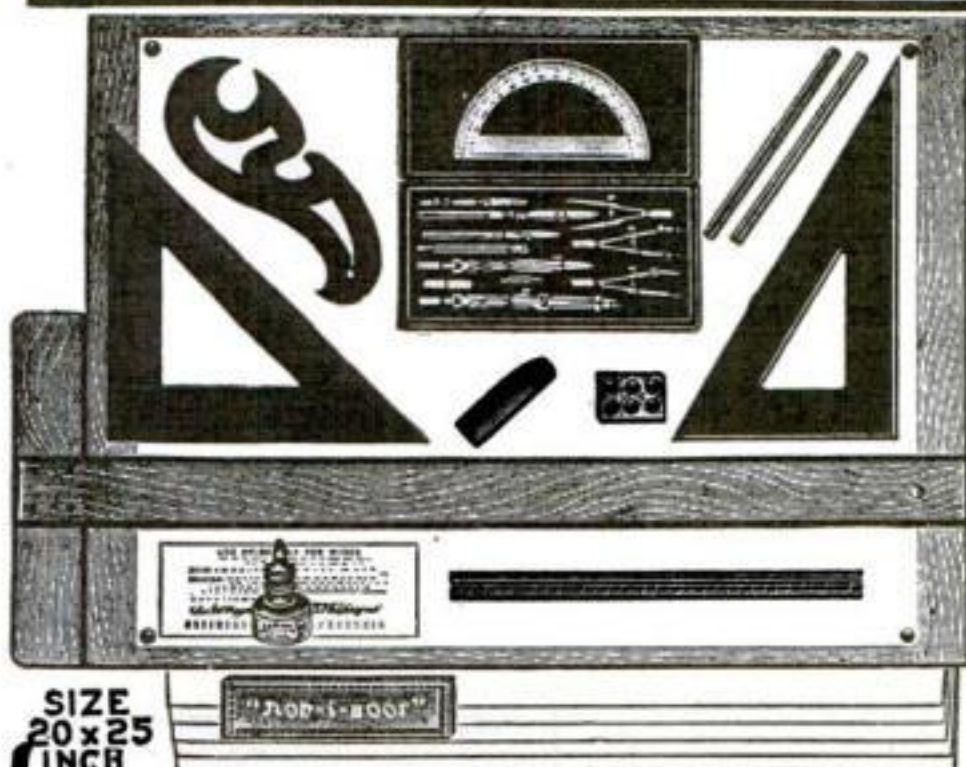
U. S. PATENT—New improved coffee percolator. Stefano Battilani, 114 Christopher Street, New York.

FOR SALE—Patent on Ford Auto Lock. Joseph Vesely, Cedar Rapids, Iowa.



# Drawing Outfit and Drawing Table

# FREE



SIZE  
20x25  
INCH



## Complete Set of Drawing Instruments and Drawing Table

Yes, I will give you this complete drawing outfit absolutely free. The instruments are in a handsome high class, plush lined folding case. They are regular draftsman's working instruments. Besides I will give you absolutely free, a 20 x 25 inch drawing board, a 24 inch T square, a 12 inch rule, a supply of drawing paper, two triangles, a French curve, pencils, erasers, thumb tacks, etc.

## Delivered at Once

The drawing table is the "Chief's Own" adjustable folding Drawing Table, same as used and needed by first class draftsmen. The complete outfit and table are delivered to you at once. You have them to work with from the very first day.

## Be a Draftsman Draw \$250<sup>00</sup> to \$300<sup>00</sup> Per Month

There is an urgent demand for skilled draftsmen. Companies are issuing calls every day for men to fill positions paying from \$250.00 to \$300.00 per month. Work is light, pleasant and profitable.

## Chief Draftsman Will Instruct You Personally

I am Chief Draftsman of a large and well known firm. I have been doing the highest paying expert drafting work for a quarter of a century and I know just the kind of training that is demanded from men who get the big salaries. I train you by giving you actual, practical work, the kind that

you must be able to do to hold permanent, big paying positions. I give you my individual instruction. If your work is right, I will advance you rapidly. If it is wrong I will show you where and make you do it right, and do all I can to make you an expert draftsman and designer in a short time. Write today without fail.

## Pay as You Wish

What I want is the right kind of men. Don't bother about expense. I will give you the working outfit free if you get in at once. I charge a very small fee for training you to be an experienced draftsman. You can pay the small cost as suits you best.

## Send Coupon for My Big New Book

Put your name and address on the coupon or a letter or a post card and send it to me today. I will send you, absolutely free and postpaid, my new book "Successful Draftsmanship," and the great special offer that I am now making on which you get the complete Draftsman's Working Outfit and Drawing Table absolutely free. You assume no obligations of any kind in sending in the coupon. Get in line for a big paying position. Getting the book and full particulars of the special offer is the first step. Don't delay—send the coupon today.

**Chief Draftsman Dobe** Dept. A-136 4001 Broadway, Chicago, Ill.

### Chief Draftsman Dobe

Dept. A-136 4001 Broadway, Chicago

Without any obligations on me whatsoever, please mail your book, "Successful Draftsmanship," and full particulars of your liberal "Personal Instruction" offer to a few students. It is understood that I am obligated in no way whatever.

Name .....

Address .....



## FOR INVENTORS

900 Mechanical Movements, also illustrations explaining 50 Perpetual Motions. My book, *Inventor's Universal Educator*, Fifth Edition, tells how to procure and sell patents. Government and other costs. Covers the matter from A to Z. 160 pages elegantly bound. Contains noted decisions of U. S. Supreme and State Courts on Patent Cases. Mechanical Movements greatly assist inventors—suggest new ideas that may prove of great aid in perfecting inventions. Tells how to select an Attorney. Has valuable information regarding Patent Sharks, Selling Agents and Brokers. Price \$2. Postage Free everywhere. Fred G. Dieterich, 681 Ouray Building, Washington, D. C.

**BLUEPRINTS:** How to read. See page 9. Mechanics' Improvement Association.

**PATENTS—Write for free Guide Book and Evidence of Conception Blank.** Send model or sketch of invention for free opinion of its patentable nature. Highest references. Reasonable terms. Victor J. Evans & Company, 156 Ninth, Washington, D. C.

**HAVE** you a practical invention to sell outright or place on royalty? Send details to Adam Fisher Mfg. Co., 183 A. St. Louis, Missouri.

**PATENTS—My fee payable in monthly installments.** Send sketch for advice. Booklet free. Frank Fuller, Washington, D. C.

**INVENTORS:** We make models, dies, tools. 28 years' experience; work guaranteed; lowest price. Manufacture of specialties our hobby. Peerless Die & Tool Company, 121 Opera Place, Cincinnati, Ohio.

**INVENTORS—Sell your ideas of patents through National Institute of Inventors, 118 Fulton, New York City.** Membership 2,500. We help you secure, develop and finance your inventions. Annual dues \$10.

**PATENTS—Send for free book.** Contains valuable information for inventors. Send sketch of your invention for Free Opinion of its patentable nature. Prompt service. (Twenty years experience.) Talbert & Talbert, 4691 Talbert Building, Washington, D. C.

**MR. ADVERTISER:** Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising Popular Science Monthly, 225 West 39th Street, New York.

## PATENT ATTORNEYS

**PATENTS.** If you have an invention which you wish to patent you can write fully and freely to Munn & Co., for advice in regard to the best way of obtaining protection. Please send sketches or a model of your invention and a description of the device, explaining its operation. All communications are strictly confidential. Our vast practice, extending over a period of seventy years, enables us in many cases to advise in regard to patentability without any expense to the client. Our handbook on Patents is sent free on request. This explains our methods, terms, etc., in regard to Patents, Trade Marks, Foreign Patents, etc., "Scientific American" contains Patent Office Notes. Decisions of interest to inventors—and particulars of recently patented inventions. Munn & Co., Solicitors of Patents, 624 Woolworth Building, New York, and 625 F Street, Washington, D. C.; Tower Building, Chicago, Illinois; Hobart Building, 528 Market Street, San Francisco, California.

**PATENTS—Herbert Jenner, Patent Attorney and Mechanical Expert, 622 F Street, Washington, D. C.** I report if a patent can be had and its exact cost. Send for circular.

**PATENTS, trade-mark, copyright.** Charges very reasonable. Metzger, Washington, D. C.

**PATENTS Promptly procured—Personal, careful and efficient service.** Highest references. Moderate fees. Send sketch or model for actual search and advice. George P. Kimmel, Master of Patent Law, 38-G Loan & Trust Building, Washington, D. C.

**SUCCEED** inventing. Brilliant book How to Finance Inventions, 242 pages sent \$2 postpaid. Author will patent and manage your invention. Attorney Baff, Worcester, Massachusetts.

**PATENTS—Send for free book.** Contains valuable information for inventors. Send sketch of your invention for Free Opinion of its patentable nature. Prompt service. (Twenty years experience.) Talbert & Talbert, 4624 Talbert Building, Washington, D. C.

**GET** your own patents. Save attorney's fees: instructions and advice free. Carl Larsen, Park Row Building, New York.

**PATENTS:** In all matters pertaining to invention consult National Institute of Inventors, 118 Fulton, New York City, having three thousand members. Booklet free.

**PATENTS!—The Expert Personal Service of this firm is of great importance to you in properly protecting your invention by patent.** (Est. 1897.) Write to John B. Thomas & Co., 902 F Street, N. W., Washington, D. C.

**"INVENTORS Adviser"** sent free on request. William C. Linton, 918 F Street, N. W., Washington, D. C. 362 University Street, Montreal, Canada.

**INVENTORS—My clients know every step taken in prosecuting their applications.** Booklet sent free on request. Warner Cumberley, 20 National Union Building, Washington, D. C.

**LACEY Patent-Sense.** "The book the inventor keeps." Free. See page 136.

**PATENTS, Trade Marks, Copyrights.** Prompt, personal, reliable service. Over 30 years' active practice. Write for terms. Book free. Address E. G. Siggers, Box 1, N. U. Building, Washington, D. C.

**PROTECT** your rights. Write for "Record of Invention," which contains forms to establish evidence of conception of your invention. Prompt personal service. Preliminary advice without charge. J. Reaney Kelly, 732 Woodward Building, Washington, D. C.

**POSTAL** brings free booklet. All about patents and trademarks and their cost. Shepherd & Campbell, Patent Attorneys, 730 8th Street, Washington.

**"INVENTORS Bulletin"** sent without charge. My free blank form "Inventors Record" for disclosing your idea simplifies procedure. Personal supervision. William H. Mulligan, Patent Attorney, 319-B, Woodward Building, Washington, D. C.

**INVENTIONS Patented:** honest and reliable service; send for free booklet of information. Frank Ledermann, 15 Park Row, New York.

**INVENTORS,** send sketch or model of your inventions for opinion concerning patentable nature and exact cost of applying for patent. Book, "How to Obtain a Patent," sent free. Gives information on patent procedure and tells what every inventor should know. Established twenty-five years. Chandice & Chandice, 412 Seventh Street, N. W., Washington, D. C.

**M. E. MILLER,** Ouray Building, Washington, D. C., patent attorney, mechanical and electrical expert. Best quality of work and results. Moderate charges. Advice free.

**DON'T** lose your rights to patent protection. Before disclosing your invention to anyone send for blank form "Evidence of Conception" to be signed and witnessed. Form and information concerning patents free. Lancaster & Allwine, 232 Ouray Building, Washington, D. C., Originators of the form "Evidence of Conception."

**PATENTS** procured—trade marks registered—A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 44 Owen Building, Washington, D. C., or 2276-Z Woolworth Building, New York.

**PATENTS,** prompt, personal, efficient service by an Attorney-at-law skilled in all branches of Patent practice Over 12 years' actual experience. Full information on request. B. P. Fishburne, 323 McGill Building, Washington, D. C.

**PATENTS.** Booklet free. Highest references. Best results. Promptness assured. Watson E. Coleman, Patent Lawyer, 624 F Street, Washington, D. C.

**PATENTS—Fees in installments.** Frank T. Fuller, formerly Lieutenant, Engineers, Washington, D. C.

**INVENTIONS** patented trade-marks registered: labels, prints, publications copyrighted; prompt service; reasonable fees; plain advice; request detailed information before placing your business. Jaynes & Jaynes, 801 Kellogg, Washington, D. C.

**PATENT** applications filed on partial payment plan. Trade-marks, copyrights, etc. Milo B. Stevens & Company, 640 F Street, Washington. Established 1864.

**PATENT** Attorney. Consulting Engineer, high-class Patent Service in all its branches. Write for particulars. M. H. Loughridge, 1457 Broadway, New York.

**PATENTS—Write for free Illustrated Guide Book and Evidence of Conception Blank.** Send model or sketch of invention for free opinion of its patentable nature. Highest references. Prompt attention. Reasonable terms. Victor J. Evans & Company, 155 Ninth, Washington, D. C.

**MR. ADVERTISER:** Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising Popular Science Monthly, 225 West 39th Street, New York.

## AGENTS AND SALESMEN WANTED

**TAILORING** Agents Wanted—Big complete sample outfit and case, nearly 200 large cloth samples, 3-price lists and everything needed for canvassing, or use in store, free to live agents. \$25.00 to \$50.00 a week; may make more. Write us to-day for free elegant outfit to begin, cloth samples, wholesale prices, special offer on a suit for yourself and full information. See our wonderful value, beautiful fabrics and styles. Established 28 years. Every garment made to measure—everything guaranteed and express prepaid. Just send a postal. American Woollen Mills Company, Dept. 1407, Chicago.

**AGENTS—Make a dollar an hour.** Sell Mendets, a patent patch for instantly mending leaks in all utensils. Sample package free. Collette Mfg. Company, Dept. 467, Amsterdam, New York.

**SCIENCE** creates new auto wonder; solves puzzling problem; no more rain or snow blurred windshields; mystic cloth works like magic; deposits invisible chemical film; one rub keeps glass clear 24 hours; one agent sold 5,000. Security Mfg. Company, Dept. 217, Toledo, Ohio.

**SOMETHING** new. A combination shoe horn and buttoner—not a button-hook—for universal use. Sells on sight at 15c; 100% profit. Sample 25c. Particulars free. Liberty Novelties, 96 Warren Street, New York.

**\$40 to \$100 a week.** Free samples. Gold sign letters anyone can put on windows. Big demand. Liberal offer to general agents. Metallic Letter Company, 431A North Clark, Chicago.

**AGENTS—Something different.** Our Eradium (Luminous) Crucifix, actually shines in the dark. Startling! Mysterious! Wonderful! Enthusiasm follows every demonstration. 150% profit on every sale. Sole manufacturers. The Pioneer Corporation, 1263 West 63rd Street, Chicago, Illinois.

**PORTRAIT** agents—Send at once for new 1920 Catalog of Picture Frames and Enlargements. Save money on your frame purchases. Send us your portraits for enlargement and get the best work and service in the country. W. G. Hannan Co., Dept. A-15, 57 East 18th Street, Chicago.

**WONDERFUL** New Chemical. \$1.00 Package equal 50 gallons gasoline. Eliminates carbon. 50% more mileage, power, speed. Guaranteed. Whirlwind seller. Auto owners buy on sight. 100% profit. Repeater. Demonstrating package, terms, territory, 10c postage. Myers & Company, 36 Baird, Cambridge, Ohio.

**IDEAL** Sideline. Business men buy on sight. \$1.00 seller. 400% profit. N. Home, 1957 Warren, Chicago.

**WONDERFUL** chance! Men's shirts and furnishings at wholesale rates, or make \$10 daily starting real business. Goodell Company, 85 Duratex Building, New York.

**MEN and Women—Become independent—own your business.** experience necessary selling our \$6,000 Accidental Death, \$30.00 Accident, \$25.00 Sick Weekly Benefits, \$10.50 yearly, half amounts \$5.50. Guaranteed steady income from renewals. \$250,000 deposited Insurance Department. Registration Dept. 8, Newark, N. J.

**\$10 or more a week** for your spare time collecting new and renewal subscriptions. We want representatives in every town in the United States. A. J. MacElroy, Subscription Manager, Popular Science Monthly, 225 West 39th Street, New York.

**VULCANIZING** Auto Tires growing and profitable business, especially now. Easy to learn. Instruction book \$1. Plants \$50 up. Catalog free. Equipment Company, 149 Canal, Cincinnati, Ohio.

**MAKE** and Sell Your Own Goods. Machinery unnecessary. Expert Chemists advice. Special attention to beginners. Write for Formula Catalog. Elmer Mystic Company, Washington, D. C.

**AGENTS:** Big money selling great household invention. Sample 25c. Particulars free. Webster & Company, 2935 North Clark Street, Chicago.

**SALESMEN** wanted to sell Electric Cigar Lighters and Moisteners. Salary or Commission. You carry stock or we ship direct. Write for Special Offer. Drake Manufacturing Company, 220 Grand, Milwaukee, Wisconsin.

**WANTED:** Man with auto in every section to sell our Big Six-In-One tool, comprising vise, pipe vise, anvil, drill press, cutting hardie and corundum grinder. Every farmer, janitor, private or public garage, small shop, etc., a prospective buyer. Outfit weighs 90 pounds, sells for \$24.00 with a fat profit to you. No trick to sell. Always pleases. Write Chicago Flexible Shaft Company, Dept. H. W. 5600 West 12th Street, Chicago.

**ABSOLUTELY** Guaranteed Proposition. Spare time only. Two different samples, ten cents. William Dudley Company, Dept. A, Albany, New York.

**SIGN** letters for windows at honest prices. Genuine gold leaf. Chicago Sign System, T326 River Street, Chicago.

**AGENTS** wanted in every city and county to sell the most wonderful household necessity ever invented. State agencies also open; select territory and write J. C. Bock Manufacturing Company, Concordia, Kansas.

**AGENTS—Make \$50 weekly** taking orders for fast selling Goodyear raincoats; hundreds of orders waiting; \$2 an hour for spare time; we deliver and collect; sample coat free; write today for agency. Goodyear Mfg. Company, A136 Goodyear Building; Kansas City, Missouri.

**MAN or Woman,** start anywhere; materials that cost 25c retail for \$5.00. Details free. Lee, Dept. 2, 3401 1/2 University Avenue, Los Angeles, California.

**FREE—Latest issue.** New Formulas. Tells how to make your own goods. Write today. S. & H. Manufacturing Laboratories, 10602, Boylston Building, Chicago.

**SALESMAN—Side or Main line,** to sell low priced 5,000 mile guaranteed tires. 30 x 3 1/4 non-skid sells for \$11.95; other sizes in proportion. Good money making proposition for live wires. Write, Consolidated Tire Co., 616 South Michigan, Chicago.

**AGENTS:** \$60 a week taking orders for Guaranteed Shoes for men, women, and children. Must give satisfaction or replaced free. Brand new proposition. Write quick for territory and samples. Thomas Shoe Company, 3661 North Street, Dayton, Ohio.

**AGENTS—Jobbers,** Catchiest Novelty Invented! Aerial Balloon makes youngsters wild with joy. Immensely interesting. Season's sensational seller. Large profit. No competition. Write immediately. Marui & Company, Tribune Building, New York.

**AGENTS—\$10-\$15 daily.** Every owner wants his gold initials on side door of automobile; applied while waiting; sale, \$1.50; profit, \$1.35. Write for general agency, our special offers and free samples. Monogram Supply Company, Dept. C, Bowers Building, Newark, New Jersey.

**RIDEZEE** will pay big money to men with autos. Install Ridezee, the Better Than Air Inner Tire. Cheaper than tubes, a light resilient substance guaranteed ten years. Equip your car at agent's price. Sell to friends. The business of the future. Ridezee Company, St. Paul, Minnesota.

**BIG** Money and Fast Sales. Every owner buys Gold Initials for his auto. You charge \$1.50; make \$1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Company, Dept. 47, East Orange, New Jersey.

**SIGN** Agents to represent us in your locality; unlimited field. Samples free. Interstate Sign Company, Dept. A, 2629 North Halstead Street, Chicago.

**AGENTS and General Agents—Make** traveling a profit instead of a loss. Go from town to town selling household necessities and securing new agents. Big income on your own and your agents' work. Write quick. Duo Company, Dept. B16, Attica, New York.

**THE** prosperous agent is a Davis agent. Line up for the Big Rush—\$40-\$60 weekly. "Lucky 11" and our 27 other varieties cut store price 1-3-1/4. Worth 150% to 200% for you. Davis Products Company, Dept. 51, Chicago.

**LYNER TYRES,** inside reinforcement for automobile tires, double mileage, prevents punctures and blowouts. Guaranteed; easily installed. Protected territory; prompt service. \$100.00 weekly easily made. Free booklet, Pelletier Rubber, Box 322, Cincinnati, Ohio.

**\$732.25** earned January by one man; others made \$200.00 to \$500.00 same month. With auto season just ahead our agents will double—triple this. You can do the same, selling this wonderful new invention—guaranteed to prevent punctures and lessen cost per mile of tire. Dept. A, Tire In-Sole Mfg. Company, Findlay, Ohio.

**AGENTS:** \$100 Weekly. Automobile owners everywhere wild with enthusiasm. Marvelous invention doubles power, mileage, efficiency. Saves ten times its cost. Sensational sales everywhere. Territory going like wildfire. \$26 Sample Outfit and Ford Car free. Write quick. L. Ballwey, Dept. 181, Louisville, Kentucky.

**STOP!** Read twice! "Everybody's Friend" offers 200% profit, money back for failure to remove grease spots from clothes and exclusive territory. 25c coin brings package. Write to day, Anson E. Palmer, 1,615 Race Street, Philadelphia, Pennsylvania.

**MAKE \$30.00** next Saturday. Speederator for Fords selling like wildfire. Used by Ford Motor officials. Makes any Ford run like a Packard. Stops stalling and bucking. Put on quick—instant satisfaction. No holes to bore. Sell ten to twelve a day easy. Splendid profits and exclusive territory. Write quick for information. Address Perrin Company, 1049 Hayward Building, Detroit, Michigan.

**ADVERTISING** solicitors, experienced; highly remunerative work. Box 83, Station B, Montreal, Canada.

**SELL** tires. Big advance in several standard make rubber tires makes our high grade low priced auto tires sell like hot cakes at old prices. Agents wanted to use and sell direct to car owners. Big profits. Auto Tire Clearing House, 1523 West 15th Street, Chicago, Illinois.

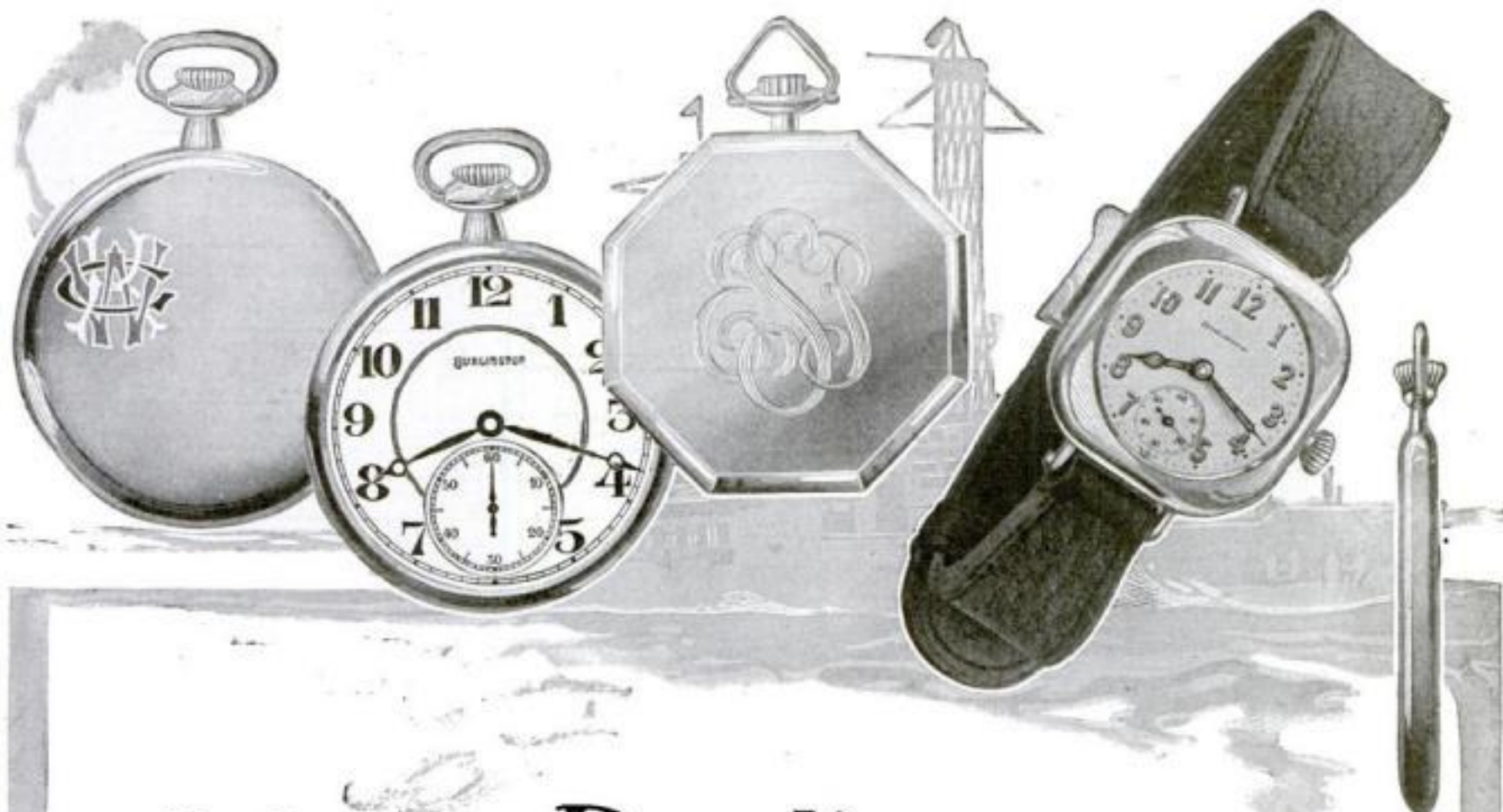
**SALESMEN—\$10-\$15 daily** selling gold transfer letters for autos to supply stores, garages, etc. Send for free samples; general agency given. Transfer Supply Company, Bowers Building, Newark, New Jersey.

**SEND** for free catalogue "Golden Opportunities" Typewritten formulas, trade secrets in every line, chemical analysis. 23 years manufacturing experience. No humbuggery. Satisfaction guaranteed. Industrial Sales Service, 73 Washington, Memphis, Tennessee.

**\$1,000 per Man per County:** Strange invention startles world—agents amazed. Ten inexperienced men divide \$40,000. Korstad, a farmer, did \$2,200 in 14 days. Sleicher, a minister, \$195 first 12 hours. \$1,200 cold cash, made, paid, banked by Stoneman, in 30 days; \$15,000 to date. A hot or cold running water bath, equipped for any home at only \$6.50. Self-heating. No plumbing or water-works required. Investigate. Exclusive sale. Credit given. Send no money. Write letter or postal to-day. Allen Mfg. Co., 541 Allen Building, Toledo, Ohio.

**\$75.00 weekly** selling Liberty-Blue Ink Powder. Enthusiastic Agents Everywhere. Sample and attractive proposition free. Norman Ovri, Hemet, California.





# 8,320 Burlingtons in the U. S. Navy—

8,320 Burlingtons have been sold to the men aboard the U. S. battleships. Practically every vessel in the U. S. Navy has many Burlington watches aboard. Some have over 100 Burlingtons. The victory of the Burlington among the men in the U. S. Navy is testimony to Burlington superiority. A watch has to be made of sturdy stuff in order to "make good" on a man-of-war. The constant vibration, the extreme heat in the boiler rooms, the cold salt air and the change of climate from the Arctic to the Tropical are the most severe tests on a watch. If a watch will stand up and give active service aboard a man-of-war, it will stand up anywhere.

## 21-Jewel Burlington \$3<sup>50</sup> A Month

And yet you may get a 21-jewel Burlington for only \$3.50 a month. Truly it is the master watch. 21 ruby and sapphire jewels, adjusted to the second, temperature, isochronism and positions. Fitted at the factory in a gold strata case, warranted for 25 years. All the newest cases are yours to choose from. You pay only rock-bottom price—yes, "bed rock-bottom price"—the lowest price at which the Burlington is sold.

**See It First!**

You don't pay a cent to anybody until you see the watch. We ship the watch to you on approval. You are the sole judge. No obligation to buy merely because you get the watch on approval.

## Write for Booklet!

Put your name and address in the coupon or on a letter or post card now and get your Burlington Watch book free and prepaid. You will know a lot more about watch buying when you read it. Too, you will see handsome illustrations in full color of all the newest cases from which you have to choose. The booklet is free. Merely send your name and address on the coupon.

**Burlington Watch Company,**  
19th Street and Marshall Blvd., Dept. A-136 Chicago, Illinois  
Canadian Office: 338 Portage Ave., Winnipeg, Man.

**Burlington Watch Co., Dept. A-136**  
19th Street & Marshall Blvd., Chicago, Ill.

Please send me (without obligations and prepaid) your free book on watches with full explanation of your cash or \$3.50 a month offer on the Burlington Watch.

Name.....

Address.....



**MAN** in each town to refinish chandeliers, brass beds, automobiles, by new method. \$10 daily without capital or experience. Write Gunmetal Company, Avenue "F," Decatur, Ill.

**PATENTS.** Write for Free Illustrated Guide Book. Send sketch or model for free opinion of its patentable nature. Highest references. Prompt attention. Reasonable Terms. Victor J. Evans & Co., 174 Ninth, Washington, D. C.

**SALESMEN,** high grade, for state and county agencies; practical device rings electric bells forever without batteries; made by leading manufacturer. Sound, permanent business; men are already making good money; territory being rapidly assigned; references and previous experience essential. Betts & Betts Corporation, Betts Building, 42nd Street, New York.

**AGENTS:** Big profits. Best and cheapest window letters made. Easily applied. Dime brings five samples. Particulars free. Stalbrit Company, 1115 Second Avenue, New York.

**SALESMEN—City or travelling.** Experience unnecessary. Send for list of lines and full particulars. Prepare in spare time to earn the big salaries—\$2,500 to \$10,000 a year. Employment services rendered members. National Salesmen's Training Association, Dept. 126G, Chicago, Illinois.

**WONDERFUL Adding Machine—Seven column capacity—retails for one dollar.** Sells itself everywhere. Most offices purchase several. Sensational agency proposition. L. J. Leishman Co., Dept. F, Ogden, Utah.

**AGENTS:** Sell rich looking 36x38 imported rugs, \$1.00 each. Carter, Tenn., sold 115 in 4 days; profit, \$57. You can do same. Write for sample offer and selling plan; exclusive territory. Sample rug by parcel post prepaid, \$1.39. E. Condon, Importer, 12 Pearl Street, Boston, Massachusetts.

**AGENTS** make 500% profit handling auto monograms, new patriotic pictures, window letters, transfer flags and novelty signs. Catalog free. Hinton Company, Star City, Indiana.

**WE** want live representatives in your locality selling Bull Dog Inner Tires. Inner casing for automobile tires. Guaranteed to prevent punctures and blow-outs, tire fabric not canvas. Double tire mileage. Easy to sell. Big demand. Protected territory. Agents making \$150.00 weekly. Eastern Auto Specialty Company, Dept. B., Utica, New York.

**AGENT** Johnson made \$10.00 first evening. Particulars, "Taymor," W-335 Broadway, New York.

**WERE** you ever offered a grocery store? You can handle Sugar, Flour, Canned Goods, Dried Fruit, Coffee and entire line of Groceries, as well as Paints, Roofing, Aluminum Ware and Automobile Oils, with no rent to pay; no money invested; take large orders from samples. Goods are guaranteed and proven quality. Selling experience not necessary. Steady, profitable work for "workers." Address Hitchcock-Hill Company, Dept. 220, Chicago, Illinois. Reference: any Bank or Express Company.

**KEROSENE** Burners for Furnaces, Cook and Heating Stoves. Economy Mfg. Company, 616 West Monroe, Chicago.

**SANITARY** Wire-Grip Brushes, Dustless Mops, Dustless Furniture Dusters, Automobile Brushes, etc., are the big money-makers of the year. Exclusive territory for live salespeople. North Ridge Brush Co., 115 Clark Street, Freeport, Illinois.

**\$5.00 to \$25.00** daily monogramming automobiles, etc., with Globe Transfer Initials. Particulars free; samples 10c. Globe Decalcomania Company (Factory), Newark, New Jersey. West of Rockies, 1785 Green Street, San Francisco.

**SPLENDID** opportunity for live sales managers to control City, County and State agencies for "Rexblu." Stevens Wiley Mfg. Company, Inc., Fairhill and Diamond Streets, Philadelphia.

**AGENTS—Steady Income.** Large manufacturer of Handkerchiefs and Dress Goods, etc., wishes representative in each locality. Factory to consumer. Big profits. Honest goods. Whole or spare time. Credit given. Send for particulars. Freeport Mfg. Company, 24 Main Street, Brooklyn, N. Y.

**BIG** profits selling Jubilee Spark Intensifier to auto owners, garages. Banishes spark plug trouble. Saves gas. Exclusive territory. Jubilee Mfg. Co., 84 Sta. C, Omaha, Nebraska.

**AGENTS—Salary and commission.** Guaranteed Automobile specialty; something new; everybody buys; E. Relax Company, Norwood, Ohio.

**YOUR** spare time properly used is worth at least \$10.00 a week. Write for particulars. Popular Science Monthly, 225 West 39th Street, New York.

**AGENTS and Crew Managers:** New fast selling food specialty. Livest article. Packed your label. Write or wire. Federal Pure Food Company, 2305-H Archer Avenue, Chicago.

**SENSATIONAL** Ford invention. Ford owner reports 100% mileage increase! Prevents carbon. Chance of lifetime for agent! Write Gasoline Economy Company, 1608 Colonial Trust Building, Philadelphia.

**GET** our plan for monogramming automobiles, trucks, hand luggage and all similar articles by transfer method; experience unnecessary; exceptional profits. Motorists, Accessories Company, Mansfield, Ohio.

**MR. ADVERTISER:** Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

**INSYDE** Tyres, inner armor for Automobile Tires, prevent punctures and double mileage of any tire. Liberal profits. Details free. American Accessories Co., Dept. 97, Cincinnati, Ohio.

**AGENTS** make \$50 weekly selling Accident and Sickness Policies for \$10 yearly. Pays \$5,000 death, increasing to \$7,500. Also \$25 weekly benefit for accident or sickness. Quick claim settlements. Permanent income from renewals. \$100,000 deposited with State. Address Insurance Company, Dept. A-5, Newark, New Jersey.

**500** Agents wanted at once for Mitchell's Magic Marvel Washing Compound. 300% profit, enormous repeater. Washes clothes spotlessly clean in ten to fifteen minutes. One thousand other uses in every home. Astonishes and delights every woman. Nothing else like it. Nature's mightiest cleanser. Contains no lye, lime, acid, or wax. Free samples furnished to boost sales. We positively guarantee the sale of every package. Exclusive territory. Own your own business. You cannot fail to make big money. Barber, Ohio, made \$600 last month. Send for free sample and proof. Hurry, hustle, grab this chance. L. Mitchell & Company, Desk 301, 1312-1314 East 61st, Chicago.

**SELL** necessities. Everybody needs and buys the "Business Guide." Bryant cleared \$800 in July. Send for sample. It's free. Nichols Company, Box 1B, Naperville, Illinois.

**AUTOMATIC** Cuff Links. Cuffs over elbows instantly without unbuttoning; lowered, they close automatically. Sell like wildfire; great convenience and shirt savers; enormous demand everywhere. Liberal exclusive proposition for experienced agents. Expandolinks Jewelers, Sheboygan, Wisconsin.

**"ONE** Raindrop" Window Operator; windows shut automatically. Sample postpaid, \$1.00. Automatic Window Company, 2107 North Percy, Philadelphia.

**ONE** sale a day means \$200 per month. Five a day—\$1,000 per month. Marvelous new Automatic Adding Machine, retails \$12.50. Work equals \$300 machine. Five-year guarantee. Write quick for protected territory and trial offer. Calculator Corporation, Dept. O, Grand Rapids, Michigan.

**AGENTS—Men and women wanted.** New Monitor Self-heating Iron; \$30 to \$50 a week actually being made now by men and women. The original—the best—the lowest priced. Nickel plated, looks good, makes good, sells fast. Guaranteed. No experience needed. Exclusive territory. Work all or spare time. Mrs. Nickson, Vt., sold 8 first half day. Evans, N. C., sold 2 dozen on Saturday. Liberal terms. Prompt service. Send for free outfit offer. Write today. The Monitor Self Iron Company, 235 Fay Street, Big Prairie, Ohio.

## A Big Advertiser Speaks

Popular Science Monthly,  
225 West 39th Street,  
New York City.

Gentlemen:

Our experience in the classified columns of Popular Science Monthly has been very satisfactory. The results received have been from high-class specialty salesmen who are the only kind that can sell our high-grade line of products. We manufacture a line of food products and toilet preparations that are above the average, require both men and women of ability to sell them, and we have found that we get this class of people as the result of our advertisements in your classified section. Needless to state we will use Popular Science Monthly regularly.

Very truly yours,

AMERICAN PRODUCTS COMPANY

This well-known concern is undoubtedly one of the biggest classified advertisers in America today, and it is reasonable to assume that they are experts in the matter of selecting the proper type of medium to carry their message to the public. They maintain a most complete system for keying their advertisements, which enables them to tell at a glance exactly what each advertisement, in each issue of each publication is producing. The fact that they haven't missed a single issue of Popular Science Monthly in over five years should answer YOUR question—"Does it Pay?"

Classified Advertising Manager

POPULAR SCIENCE MONTHLY

225 West 39th Street

New York City

**SELL** "Victorelean" Washing Wonder. It's a wonderful repeater. Free samples to boost sales. Skytt, 725 East 5th, Duluth, Minnesota.

**CALIFORNIA** Rosebuds selling like hot cakes. Agents coin money. New Stuff. Tremendous demand. Big profits. Mission Bend Company, Factory C, Los Angeles, California.

**EASY,** pleasant work for mechanics, shop men, clerks, during spare hours, will add many dollars to their salaries. Also want persons who can give full time. Big wages assured. Novelty Cutlery Company, 27 Bar Street, Canton, Ohio.

**AGENTS—Best** seller: Jem Rubber Repair for tires and tubes; supersedes vulcanization at a saving of over 800 per cent.; put it on cold, it vulcanizes itself in two minutes, and is guaranteed to last the life of the tire or tube; sells to every auto owner and accessory dealer. For particulars how to make big money and free sample, address Amazon Rubber Co., 504 Amazon Building, Philadelphia, Pennsylvania.

**AGENTS—"Make-Em-White"** Washing and Cleaning Tablets, regular gold mine for Spring—profits enormous—Free Sample—Exclusive territory. B. Thayer, 2142C Clybourn Avenue, Chicago.

**"THE** Road to Recognition." A delightfully written little book brimful of inspiration. Just the thing to inspire a young man to better effort. Price postpaid \$1.00. Book Department, Popular Science Monthly, No. 225 West 39th Street, New York.

**AGENTS—Sell** Laundry Tablets under your own name and brand. Free samples and circulars furnished with every order. Particulars free; samples fifteen cents. Kreba E. Products, College Point, New York.

**DROP** everything else. Sell guaranteed silk hosiery and underwear all or spare time; direct from factory to consumer. Big money maker. Big commissions. Prompt deliveries. C. & D. Company, Dept. 10, Grand Rapids, Michigan.

**DISTRICT** managers in \$5,000 to \$10,000 a year class can make big money with Rich Tone phonographs. My factories make 22 models from \$32.50 to \$90. If you qualify with bank references I will help you finance, carry accounts of dealers and consumers for you. Give full particulars about your standing first letter. Nat. Kawin, Sales Director, Great Eastern Manufacturers Co., 316 South Wabash Avenue, Chicago, U. S. A.

**LYNER** Tyres, inside tire protectors, prevents blowouts and punctures. Guaranteed. Enormous demand. \$100 weekly easily made. Write for sales-guarantee proposition. Pelletier Rubber Company, 2504 Vine, Cincinnati.

**AGENTS,** big profits selling famous Keen-O Polish and Rag Cleaner. Something new, samples and particulars 35c. Keen-O Polish Company, 1605 Prairie Avenue, Kenosha, Wisconsin.

**SALESMEN** wanted—Gum-peanut vending machine combinations collect \$2.50 to \$5.00 commissions each sale, \$10.00 to \$20.00 daily easy. Commissions on refills. "Sanichu," 3624 Cottage Grove, Chicago, Illinois.

**SIGNS** for store and offices. Entirely new. \$50 week easily made. Chicago Sign System, T-326 River Street, Chicago.

**AGENTS' directory—Listing** over 1,000 rapid selling agent specialties with first hand sources of supply; 128 pages, 1920 edition; postpaid 25c. Swanson, 12058 Kansas Avenue, Kansas City, Kansas.

**WATER** stills, made entirely of heavy copper, one or three gallon capacity, prices \$25.00 and \$40.00, respectively. Shipped prepaid by express or parcel post the same day we receive your order. Ideal for distilling water for automobile batteries, industrial uses, and drinking purposes. Boyer & Company, 802 Farham Building, Omaha, Nebraska.

**DOUBLE** your income every week. Nature does it while you sleep. Self addressed envelope for report. V. B. Company, Pearl River, New York.

**NATIONAL** magazine will pay fifty cents on the dollar to subscription agents. Motor Guide, Publishers Row, Rochester, Indiana.

**AGENTS—we** offer you \$8 a day selling new concentrated soft drinks; great summer hit; 30c. bottle makes 32 glasses; all flavors; just add water; lightning seller; small package; carry in pocket; outfit furnished free; send postal to-day. American Products Co., 2351 American Building, Cincinnati, Ohio.

**THREE** Licks Razor Strip will make any razor split hair. Agents wanted. Sample \$2. Three Licks Strip Company, Toledo, Ohio.

**AGENTS** wanted to sell photo pillow tops, portraits, frames, etc. Get our free sample roll offer to agents. Service Art Company, Station D, Chicago, Illinois.

## HELP WANTED

**BE** a Finger Print Expert—\$25 to \$50 a week and more in this new and fascinating profession. Finger Print Experts hold positions of independence and trust. Work intensely interesting. They are in big demand by banks, corporations, big factories, detective agencies, etc. You can qualify. Write today for special limited offer and free illustrated Book. Tells all about Finger Prints. University of Applied Science, Room 1866, 1920 Sunnyside Avenue, Chicago, Illinois.

**GOVERNMENT** positions are desirable. \$1000-\$2000 to start. Let our expert (Former Government Examiner) prepare you. Free booklet. Patterson Civil Service School, Box 5026, Rochester, New York.

**WE** want representatives in every factory. You can easily earn \$10 or \$15 a week by spending an hour a day of your spare time. Write A. J. MacElroy, Subscription Manager, Popular Science Monthly, 225 West 39th Street, New York.

**WRITE** for newspapers and magazines. Big pay. Experience unnecessary. Copyright book free. Press Reporting Syndicate, 4905, St. Louis.

**DETECTIVES** earn big money. Travel. Experience unnecessary. We train you. Particulars free. Write American Detective System, 1905 Broadway, New York.

**BE** a detective. Excellent opportunity, good pay, travel. Write C. T. Ludwig, 424 Westover Bldg., Kansas City, Missouri.

**BE** a Mirror Expert, \$3-\$10 a day; spare time home at first; no capital; we train, start you making and silvering mirrors, French method. Free prospectus. W. F. Derr, Pres., 579 Decatur Street, Brooklyn, N. Y.

**FIREMEN,** brakemen, baggage men, \$140-\$200, Colored Porters, by railroads everywhere. Experience unnecessary. 830 Railway Bureau, East St. Louis, Illinois.

**SILVERING** Mirrors—I make the French Plate. Easy to learn; immense profits, booklet free. Sam Wear, Excelsior Springs, Missouri.

**DETECTIVES** make big money. Be one! Excellent opportunities. Write American School of Criminology, Detroit, Michigan.

**VULCANIZING** auto tires growing and profitable business, especially now. Easy to learn. Instruction book \$1. Plants \$50 up. Catalogue free. Equipment Company, 21 Canal, Cincinnati, Ohio.

**MEN—Age 17 to 45.** Experience unnecessary. Travel, make secret investigations, reports. Salaries, expenses. American Foreign Detective Agency, 321, St. Louis.

**WRITE** Photoplays; \$50 each. Experience unnecessary; details free to beginners. Producers' League, 194, St. Louis.

**STOP** daily grind. Start silvering mirrors, auto headlights, tableware, etc. Plans free. Clarence Sprinkle, Dept. 95, Marion, Indiana.

**BLUEPRINTS:** How to read. See page 9. Mechanics' Improvement Association.

**MR. ADVERTISER:** Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

**DETECTIVE'S** Earn Big Money. Travel, unusual opportunity. Write Johnson's Detective Correspondence School, Dept. H, 232 Sheldon Avenue, Grand Rapids, Michigan.

**RAILWAY** traffic inspectors earn from \$110 to \$200 per month and expenses. Travel if desired. Unlimited advancement. No age limit. We train you. Positions furnished under guarantee. Write for Booklet CM-13, Standard Business Training Institute, Brooklyn, New York.

**PATENTS—Book** free. Send sketch for free opinion of patentable nature. Talbert & Talbert, 4846 Talbert Building, Washington, D. C.

**RAILWAY** mail clerks. City mail carriers wanted by government. Commence \$100 month. Men, 18-45. List positions free. Write immediately. Franklin Institute, Dept. 8 50, Rochester, New York.

**BE** prosperous. Painting portraits on glass; silvering mirrors; plating tableware; metal plating. Instructions complete \$1.00. Send to-day. Address N. S. Rorick, Dept. B, 427 Carroll Street, Akron, Ohio.





## FREE Course in Secret Service

Write quick for particulars of this amazing offer—a complete Course in Secret Service Intelligence — F R E E ! This remarkable course is based on the deductions of one of the world's most famous criminologists and is so clearly written that it makes the science of crime detection a simple study in common sense. It explains in detail the accepted methods of shadowing, roping and tracing—and also gives the complete history and solution of many celebrated crimes. In a word, it is the most complete and accurate source of knowledge available on the fascinating subject of Secret Service Intelligence.

## Earn Big Money

We are making this extraordinary offer to induce more men to take up Finger-Print work to supply the pressing need for experts. Wonderful opportunities await you in this fascinating and highly paid vocation. Governments, corporations, police departments, institutions, and individuals are constantly in need of trained Finger-Print Experts. The field is as wide as the world; the pay is big, the work intensely interesting.

## Be a Finger-Print Detective Learn in Spare Time

Learn this great game at home in your spare time. No matter what your present occupation—you can easily and quickly master every branch of the Finger-Print Detective's work and take one of the fine jobs now open. It is a new, uncrowded field in which large fees are often collected for a few hours' work. Many earn up to \$8,000 a year. Get into this great game, now! There never was a better time!

## Finger-Print Outfit Free

Mail the coupon now for big free illustrated Book on Finger Prints. With it you will also receive details of our amazing offer of a Finger-Print Outfit Free. The outfit is complete and contains genuine working instruments—the same as used by experts. With its use you will get practical training in the intensely interesting work of Finger Prints and will soon be fitted for a big-pay job as a Finger-Print Detective. If you write at once we will also include particulars of our special extra offer of the Free Course in Secret Service Intelligence.

Act quick while these amazing offers are still open. Mail coupon or write now.

**University of Applied Science**  
Desk A-120, 1920 Sunnyside Ave., Chicago, Ill.

UNIVERSITY OF APPLIED SCIENCE,  
Desk A-120, 1920 Sunnyside Ave.,  
Chicago, Ill.

Gentlemen: Without any obligation whatever, send me your new Free book on Finger Prints, and your offer of a Free course in Secret Service Intelligence.

Name.....  
Address.....  
City..... State.....  
Age..... Occupation.....



## How to Make Your Voice Success - Compelling, Friend - Winning

Through this amazingly simple secret you can quickly have a strong, clear voice of magnetic power that wins admiration, popularity and success.

**T**HINK for a moment what a big part your voice plays in your life! Do you realize that it may mean to you the difference between success and failure? Do you know that many men have risen to big jobs, high salaries, positions of prominence and leadership, through the power of their voices—while other men of equal ability have never gotten beyond small pay, routine work simply because their voices lacked the power and forcefulness to put their ideas across?

What impression does your voice make on others? Does it command attention and respect—does it possess that clear, strong, magnetic quality that draws people to you, that makes them listen eagerly to what you have to say? Can you speak in public and make your voice ring with conviction—can you sway your hearers to your wishes, inspire them with enthusiasm, hold them in rapt attention through the power of your voice?

### The World Judges You By Your Voice

The man or woman whose voice is weak, husky, flat and monotonous cannot hope to make a favorable impression on others. He or she is immediately passed by as uninteresting and unimportant. Voices that are harsh and grating, droning, sing-song, high-pitched, hesitating and lifeless mean a tremendous handicap to their owners every day of their lives.

**Do Not Be Held Back By An Imperfect Voice.**—You can make your voice win for you. No matter what type of voice you have now, you can quickly improve it. You can have a voice of rich, vibrant quality, wide range of tone, a voice of dominating power that marks you as a leader among men, that wins admiration and popularity wherever you go. For singing, too, you can possess a voice of splendid quality and range such as you have never dreamed possible.



Anyone can easily have a singing voice of clear, resonant beauty and wide range of tone through this remarkable method of vocal control

### A Simple Secret That Brings Amazing Results

Every man or woman in business or social life, every singer or public speaker, everyone who stutters, stammers or lisps

can now through a wonderful new method gain a perfect voice of success-compelling, friend-winning force.

It is all a matter of knowing how to control the organs which produce the voice. Unless you know the principles of proper control, no amount of exercises or practice of the ordinary kind will make your voice perfect. Now, through the wonderful, scientific discovery of Eugene Feuchtinger, the famous voice culturist, a perfect voice can be yours. This internationally known authority has perfected an amazingly simple



Nothing can convince others more strongly than a clear, resonant voice. Any man who ever expects to speak in public should take advantage of this remarkable offer.

system of vocal training that strengthens the controlling muscles of your voice and brings out its full power and beauty.

### Easy, Silent Practice at Home

A few minutes each day in silent practice by the exclusive Feuchtinger method soon gives you a perfect singing and speaking voice. In a remarkably short time you will be thrilled with pride to find your voice possessed of new power, brilliance and beauty. Thousands of people

all over the world have obtained almost marvelous results in improving their voices through this wonderful system. Famous European operatic singers, eminent public speakers, men and women in all walks of life enthusiastically endorse the Feuchtinger method.

### Send for Free Illustrated Book

Make your voice a success-magnet, a friend-winner. Don't let it misrepresent you, antagonize people against you, thwart your ambitions. If you want a good singing voice, clear, true and vibrant—if you want a good speaking voice, strong, vigorous and confidence-inspiring—if your voice is in any way defective, let Eugene Feuchtinger show you the way to a perfect voice. His method is guaranteed. The whole wonderful secret of a perfect voice is explained fully in an interesting Book which will be sent for the asking. Fill out and mail the Coupon now.

### PERFECT VOICE INSTITUTE

Studio A-120, 1772 Wilson Ave., Chicago, Ill.

### PERFECT VOICE INSTITUTE

Studio A-120, 1772 Wilson Ave., Chicago, Ill.

Send me your free illustrated Book, "Voice Culture" and facts about the Feuchtinger Method. I have put (X) opposite subject which interests me most. I assume absolutely no obligation.

Singing..... Stammering..... Age.....  
Speaking..... Lipping.....

Name.....

Address.....

Town..... State.....



## BUSINESS OPPORTUNITIES

**ENTER a new business.** Earn \$3,000 to \$6,000 yearly in professional fees making and fitting a foot specialty, openings everywhere with all the trade you can attend to; easily learned by anyone at home in a few weeks. At small expense; no further capital required; no goods to buy, job hunting, soliciting or agency. Address: Stephenson Laboratory, 15 Back Bay, Boston, Massachusetts.

**BEGINNERS—Complete "Mail Order System."** Address Box 1005, Atlantic City.

**WE start you in business,** furnishing everything. Men and women, \$30.00 to \$100.00 weekly operating our "New System Specialty Candy Factories" anywhere. Opportunity lifetime. Booklet free. H. Ragdale Company, East Orange, New Jersey.

**BUILD a genuine Choralion Phonograph** and save over half. Fine profits building and selling. We furnish motors, tone arms and necessary parts. Send for our catalog and free blue print offer. Choralion Phonograph Company, 623 Menger Building, Elkhart, Indiana.

**BIG profits raising Belgian Hares.** We pay you \$8.00 pair and express. Contract, literature 10c. Co-operative Supply Company, Dept. K, St. Francis, Wisconsin.

**SUBSTANTIAL manufacturing corporation** wants capable man to establish branch and manage salesmen; \$300 to \$1,500 necessary; you handle own money; will allow expenses to Baltimore if you will qualify. For particulars address Secretary, 416 North Howard Street, Baltimore, Maryland.

**CONTROL new exclusive phonograph record exchange** business for your town. \$25 capital required. Saton Science, Oneonta, New York.

**BUILD up your own business.** We will manufacture article in demand everywhere, retailing \$1.50, under your label, at 30c each. We guarantee to teach you how to sell retail, wholesale, through agents, personally, and by mail free. Tremendous repeat business; one of our customers made \$1000 one month. Write for proof. Scientific Laboratories, 27 Court Street, Brooklyn, New York.

**HOME-WORK:** Ten valuable Articles, instructions for making, how and where to sell them, only \$1.00. Act now and succeed to-morrow. Home Aid Company, West Milan, New Hampshire.

**RAISE Silver Foxes!** Large profits. Easy to raise. Exceptional opportunity. New syndicate. Easy terms. Particulars free. C. T. Dryx, 5244-87 South Maplewood Avenue, Chicago.

**TEN CENT package Metler's Compound** makes one pint excellent ink. Sample 5 cents. A. D. Metler, Louis Street, New Brunswick, New Jersey.

**STUDY Human Nature,** make people like you, get along better, make more money, develop a winning personality, learn to know people as they are. Send 5 cents (stamp) for "Personal Power," a little book that points the way. Address, Progress League, 4431 Union Square, New York.

**UNED Correspondence Courses** of all kinds sold. (Courses bought.) Lee Mountain, Flagg, Alabama.

**YOU can earn \$50 to \$150 a week** as an Ad-Writer. Experience unnecessary. Particulars for stamp. R. F. Koehler, Dept. 60, 156 West Vernon, Los Angeles.

**I MADE \$30 a week** evenings with a small mail-order business. Free Booklet tells how. 2c postage. Al Scott, Cohoes, New York.

**MEN Wanted—Manufacturing concern** wants men to open office and manage salesmen; wonderful opportunity to make big money; from \$200 to \$2000 necessary. Write Director of Sales, Conner Machine & Tool Company, Springfield, Mass.

**START Business.** Practical chemists will supply you with formulas, trade secrets, chemical information, manufacturing processes, analysis. Klouin & Company, 5169 Jefferson Street, Philadelphia, Pennsylvania.

**PATENTS Procured—Trade Marks Registered—A comprehensive, experienced, prompt service** for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 44 Owen Building, Washington, D. C.

**EXPERT Chemist** will furnish Formula and Trade Secrets in all lines. Lists free. W. L. Cummings, Ph.D., Gordon Avenue, Syracuse, New York.

**VULCANIZING Auto Tires** growing and profitable business, especially now. Easy to learn. Instruction Book \$1. Plants \$50 up. Catalogue free. Equipment Company, 151 Canal Street, Cincinnati, Ohio.

**BE a detective.** Excellent opportunity, good pay, travel. Write C. T. Ludwig, 424 Westover Bldg., Kansas City, Mo.

**DOLLARS yearly** in your backyard. No ginseng, mushroom dope. New ideas. Investigate. Particulars free. C. Metz, 313 East 86th St., New York.

**INSIDE tyres, inner armor** for automobile tires, double mileage and prevent punctures and blowouts. Quickly applied. Cost little. Demand tremendous. Profits unlimited. Details free. American Automobile Accessories Co., Dept. 97B, Cincinnati, Ohio.

**BUY and exploit practical inventions.** Trade for property. Form companies. Sell county rights. Adam Fisher Mfg. Co., 183D, St. Louis, Missouri.

**WOULD you like to study law** in your spare moments? I have a splendid opportunity to offer you. Send me your name and address right now. C. F. Dunlap, 1027 Manhattan Building, Chicago.

**MAN or Woman, start anywhere;** materials that cost equipment. Call or write for literature. Anderson Steam Vulcanizer Company, 2302 Grand Avenue, Kansas City, Missouri.

**MAN or Woman, start anywhere;** materials that cost 25c retail for \$5.00. Details free. Lee, Dept. 1, 3401 1/2 University Avenue, Los Angeles, California.

**DO You know every move your attorney makes?** Inventors, my clients are immediately informed of every step in the prosecution of their applications. Write now send sketch. Office of Warner I. Cumberley, Patent Attorney, 20 National Union Building, Washington, D. C.

**20,000 honest, legitimate, workable mail order formulas,** \$2.00. Nearly all new. Covers practically entire field. Money back guarantee. C. J. Callender, Square Deal Mail Order Man, 3237 Garfield Avenue, Kansas City, Missouri.

**\$10,000 a year** is not unreasonable for you to expect if you answer this advertisement. Necessary qualifications any age, ordinary intelligence, and ambition. This is the greatest opportunity of the 20th Century. Send name. Emporium 3508, White Plains Road, New York City.

**SPECIAL service** contains excellent mail-order plans and valuable information. 25 issues, \$1.00. Two sample numbers, 10c. A. Hyde, 23 West 31st Street, New York.

**LARGE profits** in the plating business. Unlimited field, pleasant work, either sex. Small cost to start. Full instruction, formulas, etc., for one dollar. F. R. Baker, Box 934, Oklahoma City, Oklahoma.

**ART leaded stained glass window work,** beautiful effects produced for homes, churches, signwork, etc. Complete instructions with necessary material. Illustrated particulars free. Ed. Mahler (Box 5), Woodhaven, New York.

**\$1 does it.** Texas oil land making holders big money every day. Bank references furnished. Investigate or thoroughly, that's all we ask. Results count. Our plan \$1 down, balance monthly, few months gives you Warranty Deed to land. May pay profits \$250 or more monthly. Maps, reports, established facts free. Address: Sourlake Texas Oil Co., 866 DeMott, St. Louis, Missouri.

**LEARN all about auto tractor and gas engine business.** Splendid opportunity to every ambitious man wishing to earn \$100.00 to \$400.00 month. Write for free book, "Making you Master of the Auto." Milwaukee Motor School, Dept. 895, 555-7 Downer Avenue, Milwaukee.

**REAL estate is booming.** Why not learn the business; have an office of your own and make fat commissions? We teach you by mail in 21 lessons. Write for booklet P. Free. Frederick Jenkins, New Rochelle, New York.

**FREE—The Western Miner** three months to get acquainted; devoted to an exceptional investment and general news. The Western Miner, 2541 West 37th Avenue, Denver, Colorado.

**SIGNS—Start a business** at home, something every store needs. Learn to make glass and electric signs by our new easy process without the use of brush. Big money, easy to learn. First sign will pay cost of learning. Morris Electric Signs & Mirror Co., Box 74, Westport Station, Kansas City, Missouri.

**WE will start you in the cleaning and dyeing business.** Little capital needed, big profits. Write for booklet P. Free. Ben-Vonde Systems, Dept. E, Charlotte, North Carolina.

**THE builders' supply and equipment business** requires no capital and commissions can be earned while business is being learned by mail. Particulars free. Construction Bureau, 334 Shepard Building, Grand Rapids, Michigan.

**PATENTS—Book free.** Send sketch for free opinion of patentable nature. Talbert & Talbert, 4847 Talbert Building, Washington, D. C.

## STAMPS AND COINS

**NEVER Sell Old Coins** until you see our Copyrighted 6x9 Illustrated Coin Value Book (New Edition)—showing high prices we pay. \$100.00 paid for 1894 dime. 8 Mine. Send 10c for your copy to-day. You may have valuable coins. International Coin Co., Box 151-M, Philadelphia, Pennsylvania.

**CALIFORNIA gold, quarter size, 27c; 5/16 size, 53c.** White cent and catalogue 10c. Norman Shultz, King City, Missouri.

**100 Different Stamps, 10c; 200, 25c.** Approvals. Michaels, 5600 Prairie, Chicago.

**STAMPS—61 different, also interesting lists free.** Postage 2c. Payn Stamp Company, 138 North Wellington Street, Los Angeles, California.

**50 Excellent stamps—8c.** Roessers' Stamp News, year 25c—Merits approvals—60c discount. 5 French Colonies Free. Postage 2c. Edwin Bailey, Farmingdale, New York.

**158 Genuine Foreign Stamps—Mexico War Issues** Venezuela, Salvador and India Service, Guatemala, China, etc., only 10c. Finest Approval Sheets 50c to 60c. Agents wanted. Big 72-p. Lists Free. We buy stamps. Established 25 years. Hustman Stamp Company, Dept. 55, St. Louis, Missouri.

**STAMPS, 20 All Different, 3 cents.** Mention paper. Quaker Stamp Co., Toledo, Ohio.

**\$2 to \$600 paid** for hundreds of old coins dated before 1895. Send 10 cents at once for new illustrated coin value book. Size 4x7. It may mean your fortune. Clarke & Co., Coin Dealers, Box 76, LeRoy, N. Y.

**PACKET "A" 100 varieties foreign stamps, 20c.** F. J. Pope, Charlotte, Vermont.

**17 varieties Bulgaria stamps, 20c.** List of 7,000 varieties low priced stamps free. Chambers Stamp Co., 111C, Nassau Street, New York City.

**STAMPS—50 varieties, Transvaal, Brazil, Peru, Cuba, Mexico, etc., and Album 10c.** 50 different U. S. 25c. 1,000 hinges, 10c. 1,000 mixed 40c. List free. I buy stamps. C. Stegman, 5949 Cote Brilliante, St. Louis, Missouri.

**CALIFORNIA gold, quarter size and Columbia Nickel.** 30c. Villa coin and catalog, 10c. Homer Schultz, Union Star, Missouri.

**STAMPS—50 different British Guiana, China, Jamaica, Portugal, Venezuela, etc., 10c; 1,000 all different, one collection in itself, \$5.00; 100 var. U. S., 30c; 1,000 hinges, 10c; Agents wanted, 50c. List free. I buy stamps. L. B. Dover, Overland, Missouri.**

**BEST one cent approvals** in America. F. F. Hand, 1117 South 60th Street, Philadelphia, Pennsylvania.

**STAMPS—12 different from warring nations, 10c; 10 different foreign coins, 25c; 10 Uruguay stamps for 10c.** Lists free. Toledo Stamp Company, Toledo, Ohio.

**OLD coins, large spring selling catalogue** of coins for sale, free. Catalogue quoting prices paid for coins, ten cents. William Henslein, 101-A Tremont Street, Boston, Massachusetts.

**STAMP collections, coins, bills, antique firearms, swords.** Catalog free. Antique Shop, 33-A South 18th, Philadelphia, Pennsylvania.

**60 Different Asia stamps 25c; C. Reitter, Box 1054.** Detroit, Michigan.

**TRIANGLE Approvals—1/2c up.** Three unused stamps free to approval applicants sending references. Harford Stamp Company, Dept. 8, Germantown, Pennsylvania.

**THOUSANDS paid for Old Coins.** Save all before 1895 and send for 1920 premium book, ten cents, with large copper cent fifteen cents, it may mean your fortune. E. C. Harr, Nora Springs, Iowa.

**FRENCH Colonial stamps—9 beautiful unused pictorial varieties, 5c.** Fennell Stamp Company, Dept. C, Fullerton Building, St. Louis.

**FINEST British Colonial approvals.** Price moderate. Riedel, Schenectady, New York.

**BEAUTIFUL French Colonial stamps, 150 different, \$1.00.** Nickles, 122 Florida Avenue, Washington, D. C.

**50,000 coins, medals, bills, stamp collections, antique firearms, relics.** Lists free. Nagy, 33 South 18th, Philadelphia.

**REFERENCES bring free packet** and low priced approvals. J. W. Hyson, Melrose, Massachusetts.

**800 stamps, only 25c.** John Hammond, 706 Gladstone, Baltimore, Maryland.

**FIFTY different war stamps, 50c.** Send for lists. Williams Company, 291 Autumn Avenue, Brooklyn, New York.

**MR. ADVERTISER:** Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

## Two Money Making BOOKS

## Elements of Industrial Chemistry.

By ALLEN ROGERS. Contents: General Processes; Water, Its Uses and Purification; Fuels; Sulphuric Acid; Nitric Acid; Elements and Inorganic Compounds; Ceramic Materials and Products; Pigments; Fertilizers; Illuminating Gas; Coal Tar and Its Distillation Products; The Petroleum Industry; The Destructive Distillation of Wood; Oils, Fats and Waxes; Lubricating Oils; Soap, Soap Powder and Glycerine; Essential Oils; Resins, Oleo-Resins, Gum-Resins and Gums; Varnish, Sugar; Starch, Glucose, Dextrin and Gluten; Beer, Wine and Liquor; Textiles; Dyestuffs and Their Applications; The Paper Industry; Explosives; Leather. About 600 pages, illustrations. Price, \$3.00, Postpaid.

## Techno-Chemical Receipt Book.

By BRANNT and WAHL.

This volume gives an accurate and compendious collection of approved recipes and processes of practical application in the industries and for general purposes. It is a compact repository of practical and scientific information, containing thousands of recipes and processes covering the latest and most useful discoveries in chemical technology and their practical application in the useful arts and industries.

5 1/2 by 7 1/2 inches. Cloth Binding. 495 Pages 78 Illustrations. Price, \$2.50 postpaid

BOOK DEPT. POPULAR SCIENCE MONTHLY  
225 West 39th Street, New York City

## This May Mean \$100 TO YOU

You are either going up the ladder of success or you are going down. You can't sit on the same round month after month.

Then it's up to you to prepare yourself for bigger work and bigger pay.

There is no better way to do this than to keep up with all the newest inventions, improvements and discoveries in mechanics and science.

Popular Science Monthly gives you month by month all the latest inventions and improvements in automobiles, flying, wireless, tools, and labor savers and in fact all the newest devices in all kinds of machinery. A \$3.00 investment may mean \$100 or more to you. Others have received suggestions from this magazine of practical information worth many times this.

The successful man is the man who is prepared when opportunity knocks at his door. Be ready for that bigger job by reading every issue of Popular Science Monthly. Only \$3.00 for a whole year's subscription. Act now.

~~~~~USE THIS COUPON~~~~~  
POPULAR SCIENCE MONTHLY,  
225 West 39th Street, New York.

I enclose \$3.00 (P.O. money order or check), send Popular Science Monthly for one year to

Name .....

Address .....

City .....

State .....



# The Shortest, Easiest and Surest Road to Prosperity and Success

## A Subtle, Basic and Fundamental Principle of Success and Supremacy

**T**HIS SUBTLE PRINCIPLE in my hands, without education, without capital, without training, without experience, and without study or waste of time and without health, vitality or will power has given me the power to earn more than a million dollars without selling merchandise, stocks, bonds, books, drugs, appliances or any material thing of any character.

This subtle and basic principle of success requires no will power, no exercise, no strength, no energy, no study, no writing, no dieting, no concentration and no conscious deep breathing. There is nothing to practice, nothing to study, and nothing to sell.

This subtle and basic principle of success does not require that you practice economy or keep records, or memorize or read, or learn, or force yourself into any action or invest in any stocks, bonds, books or merchandise.

This subtle principle must not be confused with Metaphysics, Psychology, New Thought, Christian Science, arbitrary optimism, inspiration or faith.

No one has yet succeeded in gaining success without it.

No one has ever succeeded in failing with it.

It is absolutely the master key to success, prosperity and supremacy.

### My True and Actual Experience

When I was eighteen years of age, it looked to me as though I had absolutely no chance to succeed. Fifteen months altogether in common public school was the extent of my education. I had no money. When my father died, he left me twenty dollars and fifty cents, and I was earning hardly enough to keep myself alive. I had no friends for I was negative and of no advantage to any one. I had no plan of life to help me solve any problem. In fact I did not know enough to know that life is and was a real problem, even though I had an "acute problem of life" on my hands. I was blue and despondent and thoughts of eternal misery arose in my mind constantly. I was a living and walking worry machine.

I was tired, nervous, restless. I could not sleep. I could not digest without distress. I had no power of application. Nothing appealed to me. Nothing appeared worth doing from the fear that I could not do anything because of my poor equipment of mind and body. I felt that I was shut out of the world of success and I lived in a world of failure.

I was such a pauper in spirit that I blindly depended on drugs and doctors for my health, as my father before me. I was a "floater" and depended on luck for success if I were to have any. I consciously or unconsciously believed that if I ever were to have health and success, the result would have to come through some element of ease or assistance or through some mysterious or magical source. The result of this attitude on my part was greater weakness, sickness, failure and misery as is always the case under similar condition.

Gradually my condition became worse. I reached a degree of misery that seemed in-

tolerable. I reached a crisis in my realization of my failure and adverse condition.

Out of this misery and failure and pauperism of spirit—out of this distress—arose within me a desperate reaction—"a final effort to live"—and through this reaction, arose within me, the discovery of the laws and principles of life, evolution, personality, mind, health, success and supremacy. Also out of this misery arose within me the discovery of the inevitable laws and principles of failure and sickness and inferiority.

When I discovered that I had unconsciously been employing the principles of failure and sickness, I immediately began to use the principles of success and supremacy. My life underwent an almost immediate change. I overcame illness through health, weakness through power, inferior evolution by superior evolution, failure by success, and converted pauperism into supremacy.

I discovered a principle which I observed that all successful personalities employ, either consciously or unconsciously. I also discovered a principle of evolution and believed that if I used it, that my conditions would change, for, I had but one disease—failure, and therefore there was but one cure—success and I began to use this principle and out of its use arose my ambition, my powers, my education, my health, my success and my supremacy, etc., etc.

You also may use this principle of success deliberately, purposefully, consciously and profitably.

Just as there is a principle of darkness, there is also a principle of failure, ill-health, weakness and negativeness. If you use the principle of failure consciously or unconsciously, you are sure always to be a failure. Why seek success and supremacy through blindly seeking to find your path through the maze of difficulties? Why not open your "mental eyes" through the use of this subtle success principle, and thus deliberately and purposefully and consciously and successfully advance in the direction of supremacy and away from failure and adversity?

I discovered this subtle principle—this key to success—through misery and necessity. You need never be miserable to have the benefit of this subtle principle. You may use this success principle just as successful individuals of all time, of all countries, of all races, and of all religions have used it either consciously or unconsciously, and as I am using it consciously and purposefully. It requires no education, no preparation, no preliminary knowledge. Any one can use it. Any one can harness, employ and capitalize it, and thus put it to work for success and supremacy. Regardless of what kind of success you desire, this subtle principle is the key that opens the avenue to what you want.

It was used by Moses, Caesar, Napoleon, Theodore Roosevelt, Mrs. Mary Baker Eddy, John D. Rockefeller, W. R. Hearst, Herbert Spencer, Emerson, Darwin, J. P. Morgan, Harriman, Woodrow Wilson, Bryan, Charles Schwab, Cyrus Curtis, Lloyd-George, Clemenceau, Charles E. Hughes, Abraham Lincoln, George Washington, Marshall Field, Sarah Bernhardt, Galli Curci, Nordica, Melba, and thousands and thou-



sands of others—the names of successful men and women of all times and of all countries, and of all religions and of all color make a record of the action of this subtle principle of success. None of these individuals could have succeeded without it—no one can succeed without it—no one can fail with it.

### We Owe Each Other

Every one realizes that human beings owe a duty to each other. Only the very lowest type of human being is selfish to the degree of wishing to profit without helping someone else. This world does not contain very great numbers of the lowest and most selfish type of human beings. Almost everyone in discovering something of value also wants his fellowman to profit through his discovery. This is precisely my attitude. I feel that I should be neglecting my most important duty towards my fellow human beings, if I did not make every effort—every decent and honest effort—to induce every one to also benefit to a maximum extent through the automatic use of this subtle principle.

I fully realize that it is human nature for men and women to have less confidence in this principle because I am putting it in the hands of thousands of individuals for a few pennies, but I cannot help the negative impression I thus possibly create, I must fulfill my duty just the same.

I do not urge any one to procure it because I offer it for a few pennies, but because the results are great—very great.

This subtle principle is so absolutely powerful and over-mastering in its influence for good, profit, prosperity and success, that it would be a sin if I kept it to myself and used it only for my personal benefit.

So sure am I of the truth of my statement—so absolutely positive am I of the correctness of my assumption and so absolutely certain am I that this principle in your hands, will work wonders for you that I am willing to place this principle in your hands for twenty-four hours at my risk and expense. You will recognize the value of this principle within twenty-four hours—in fact, almost immediately as you become conscious of it, you will realize its practicability, its potency, its reality and its power and usability for your personal profit, pleasure, advancement, prosperity and success.

Thousands of individuals claim that the information disclosing and elucidating the secret principle of success is worth a thousand dollars of anyone's money. Some have written that they would not take a million dollars for it.

You will wonder that I do not charge a thousand dollars for this information—for disclosing this principle, after you get it into your possession and realize its tremendous power and influence.

I have derived such tremendous results—amazing results from its power, that I want every man, woman and matured child to have this key to success, prosperity and wealth. This is why I am willing to send it to any one—to any address—on approval without a single penny in advance.

You would never forgive me, and I could never forgive myself, nor could the creative forces of the Universe forgive us, if I failed to bring you to the point of using this subtle principle of success. You would never forgive me if I failed to do for you that which you would do for me, if our positions were reversed.

SEND NO MONEY. Just sign and mail the coupon and you will receive by return mail the Master principle—the Master idea—"THE SUBTLE PRINCIPLE OF SUCCESS" in a Master letter, the equal of which you have never read or seen.

This "SUBTLE PRINCIPLE OF SUCCESS" can solve your every problem—absolutely.

ALLOIS P. SWOBODA, 799 Berkeley Building, WEST 4TH STREET, NEW YORK CITY

You may send me, at your risk, "THE SUBTLE PRINCIPLE OF SUCCESS."

I promise to either re-mail it to you, within twenty-four hours of its receipt by me, or to send you One Dollar, which I understand pays in full for mailing, writing, composing and advertising this "SUBTLE PRINCIPLE OF SUCCESS."

It is understood that I am to be under no other obligation, neither now nor later.

Name..... (Write plainly)

Address..... State.....

City.....

NOTICE.—If you send One Dollar to-day, with coupon, it will be refunded to you, if you are not completely satisfied. You are to be the sole judge.

N. B.—On account of the increasing cost of advertising, the price of the Subtle Principle of Success will be double in the future.

Note.—The above statements are absolutely guaranteed in every way.





## Get Into This New Big Pay Field Now!

**Trained Traffic Experts Earn \$2500 to \$10,000 a Year and More**

Do you want to get into a field of work that is uncrowded—where the job will seek you instead of you looking for it? Do you want to earn \$2,500 to \$10,000 or more a year? Do you want a position of prestige and independence? Do you want to be one of the biggest—one of the most important men of your company? Of course you do! Then train for traffic work—be a traffic expert.

Transportation today is the country's second largest industry. Four billions of dollars are annually spent in freight charges. Yet perhaps eight of every ten shippers are losing money. And why? Just this: few of the men now in traffic work actually know how to route, classify and pack freight to get the cheapest rates. Millions of dollars are being wasted in this way. 100,000 more competent, well-trained traffic men are needed to stop these losses. Be one of these experts and you won't have to look for a job. The job will look for you. You may almost set your own salary!

## THOUSANDS OF JOBS OPEN—TRAIN FOR ONE IN SPARE TIME

Right now opportunities are unlimited. The great boom in both foreign and domestic trade are crowding the railroads and the Merchant Marine to their carrying capacity. Thousands of men trained in traffic work, are wanted to direct this great flow of trade. Railroads, shippers, and shipowners are literally begging for men. You don't have to quit your job to qualify for one of these splendid positions. Just as we have already trained thousands of others so can we train you—right in your own home, in your spare time. Traffic men of national reputation, the recognized leaders of the field, will tell you all the secrets of Interstate Commerce. The training is thorough, yet easy and interesting. The cost is but a few cents a day. Get in now! A splendid future and a quick success at a big pay job awaits you!

### Write for FREE Book

Let us send you "Opportunities and Requirements for Traffic Work." It is a remarkable book that explains in detail this great system of training. It shows how men must be trained in traffic work. It tells all about this wonderful organization of expert traffic men who include such men as T. Albert Gantt, Traffic Manager, Corn Products Refining Company; William Scott Cowie, American Freight Board Committee; Samuel G. Lutz, Vice-President, Chicago & Alton Railroad, and nearly 200 others of equal prominence. They have banded together to correct the big mistakes made daily in shipping freight, that are wasting millions of dollars every year. They are giving their time to train men to right this condition. You will learn how the A. C. A. Advisory Traffic Council renders an indispensable service to the successful traffic men. Get this great, new free book now. It will open your eyes to the splendid opportunities in this fascinating new profession. Mail the coupon, or send a letter now to the

**American Commerce Association**  
Dept. 146, 4043 Drexel Blvd.  
Chicago, Illinois

AMERICAN COMMERCE ASSOCIATION,  
Dept. 146, 4043 Drexel Boulevard,  
Chicago, Illinois.

Please send me, without obligation on my part, your free book, "Opportunities and Requirements for Traffic Work." Also tell me how I can qualify as a traffic expert.

Name.....

Address.....

Occupation.....

## BE AN EXPERT

**Auto and Tractor Mechanic Earn \$100 to \$400 a Month**

Young man, are you mechanically inclined? Come to the Sweeney School. Learn to be an expert. I teach with tools not books. Do the work yourself, that's the secret of the

### SWEENEY SYSTEM

of practical training by which 5,000 soldiers were trained for U. S. Government and over 20,000 expert mechanics. Learn in a few weeks; no previous experience necessary.

**FREE** Write today for illustrated free catalog showing hundreds of pictures men working in new Million Dollar Trade School.

### LEARN A TRADE

**Sweeney**  
SCHOOL OF AUTO-TRACTOR-AVIATION  
422 SWEENEY BLDG. KANSAS CITY, MO.

## Copy this Sketch

and let me see what you can do with it. Many newspaper artists earning \$30.00 to \$125.00 or more per week were trained by my course of personal individual lessons by mail. PICTURE CHARTS make original drawing easy to learn. Send sketch of Uncle Sam with 6c in stamps for sample Picture Chart, list of successful students, examples of their work and evidence of what YOU can accomplish. Please state your age.

### The Landon School

of CARTOONING and ILLUSTRATING  
1251 Schofield Bldg. Cleveland, Ohio

## Get Bigger Pay through ELECTRICITY



You will find in HAWKINS GUIDES just what you need to know about electricity. In simple everyday language—complete, concise, to the point. In questions and answers. A complete standard course in Electrical Engineering. Send for your set today to look over.

### HAWKINS ELECTRICAL GUIDES

3500 PAGES  
4700 PICTURES  
POCKET SIZE  
FLEXIBLE COVERS  
\$1 A NUMBER  
\$1 A MONTH

Magnetism—Induction—Experiments—Dynamoes—Electric Machinery—Motors—Armatures—Armature Windings—Installing of Dynamos—Electrical Instrument Testing—Practical Management of Dynamos and Motors—Distribution Systems—Wiring—Wiring Diagrams—Sign Flashers—Storage Batteries—Principles of Alternating Currents and Alternators—Alternating Current Motors—Transformers—Converters—Rectifiers—Alternating Current Systems—Circuit Breakers—Measuring Instruments—Switch Boards—Power Stations—Installing—Telephone—Telegraphs—Wireless—Bells—Lighting—Railways. Also many modern Practical Applications of Electricity and Ready Reference Index of the 10 numbers.

Shipped to you FREE. Not a cent to pay until you see the books. No obligation to buy unless you are satisfied. Send coupon now—today—and get this great help library and see if it is not worth \$100 to you—you pay \$1.00 a month for 10 months or return it.

**SEND NO MONEY**

THEO. AUDEL & CO., 72 Fifth Ave., N. Y. Please submit for examination Hawkins Electrical Guides (\$1 each). Ship at once, prepaid, the 10 numbers. If satisfactory, I agree to send you \$1 within seven days and to further mail you \$1 each month until paid.

Signature.....  
Occupation.....  
Employed by.....  
Residence.....  
Reference.....

P.S.M.-6-20

## Mining Engineering For Your Profession

A wide and profitable field, not overcrowded. The Michigan College of Mines (established 1886) offers comprehensive four year course which can be completed in three calendar years. Its breadth provides foundation for expert specialization in that field of engineering which most appeals to the student. Theoretical work accompanied with practical experience. College is located in center of one of the world's greatest copper mining districts. Close relations constantly maintained with mines, mills, smelters, electrolytic and power plants which are practically a part of the college equipment and a factor of enormous value in instruction. Managers of large operations regularly lecture to classes. Region affords unusual opportunities for geological study. Nine Buildings, Advanced Methods, Vigorous Athletics, Bowling, Billiards, Tobogganing, "M. C. M. Men Make Good." For descriptive book, address 262 College Ave., Houghton, Mich.

### Michigan College of Mines



I won World's First Prize for best course in Penmanship. Under my guidance you can become an expert penman. Am placing many of my students as instructors in commercial colleges at high salaries. If you wish to become a better penman, write me. I will send you FREE one of my Favorite Pens and a copy of the Ransomian Journal. Write today.  
**C. W. RANSOM, 488 Essex Bldg., Kansas City, Mo.**

## Learn Electricity IN 3 MONTHS



No need of taking from 1 to 4 years at America's greatest practical institution. Finest equipment. No books. No classes. All individual instruction. No special education necessary. Day and evening school. Open all year. Enter any time. Earn while you learn. Also courses in Drafting, Plumbing and Motion Picture Operating.

Send for free book now. Be sure to state which course interests you.  
**COYNE TRADE AND ENGINEERING SCHOOL, Dept. 36, 39-51 E. Illinois St., Chicago, Ill.**

## Electrical Engineering

men with training are in demand. For more than a quarter of a century, this school has been training men of ambition and limited time, for the electrical industries. Condensed course in Electrical Engineering enables graduates to secure good positions and promotions. Theoretical and Practical Electricity. Mathematics, Steam and Gas Engines and Mechanical Drawing. Students construct dynamos, install wiring and test electrical machinery. Course with diploma complete

### In One Year

Over 3000 men trained. Thoroughly equipped fireproof dormitories, dining hall, laboratories, shops. Free catalog. 28th year opens Sept. 29, 1920.  
**BLISS ELECTRICAL SCHOOL 182 Takama Ave., Washington, D. C.**



**Begin Today—Write for My FREE BOOK**  
I can make a good penman of you at home during spare time. Write for my FREE BOOK, "HOW TO BECOME A GOOD PENMAN." It contains specimens and tells how others mastered penmanship by the Tamblyn System. Your name will be elegantly written on a card if you enclose stamp to pay postage. FREE BOOK—Write for it Today.  
**F. W. Tamblyn, 437 Ridge Bldg., Kansas City, U.S.A.**



**DO YOU LIKE TO DRAW**  
Cartoonists Are Well Paid

We will not give you any grand prize if you answer this ad. Nor will we claim to make you rich in a week. But if you are anxious to develop your talent with a successful cartoonist, so you can make money, send a copy of this picture with 6c in stamps for portfolio of cartoons and sample lesson plate, and let us explain.

**THE W. L. EVANS School of Cartooning**  
825 Leader Bldg., Cleveland, O.

## Free to Writers!

A WONDERFUL BOOK—read about it. Tells how easily Stories and Plays are conceived, written, perfected, sold. How many who don't DREAM they can write, suddenly find it out. How the Scenario Kings and the Story Queens live and work. How bright men and women, without any special experience, learn to their own amazement that their simplest ideas may furnish brilliant plots for Plays and Stories. How one's own imagination may provide an endless gold-mine of ideas that bring Happy Success and Handsome Cash Royalties. How new writers get their names into print. How to tell if you ARE a writer. How to develop your "story fancy," weave clever word-pictures and unique, thrilling, realistic plots. How your friends may be our worst judges. How to avoid discouragement and the pitfalls of Failure. **HOW TO WIN!** This surprising book called "The Wonder Book for Writers," is ABSOLUTELY FREE. No charge. No obligation. YOUR copy is waiting for you. Write for it NOW. Just address.....





## “Here’s an Extra \$50, Grace —I’m making real money now!”

“Yes, I’ve been keeping it a secret until pay day came. I’ve been promoted with an increase of \$50 a month. And the first extra money is yours. Just a little reward for urging me to study at home. The boss says my spare time training has made me a valuable man to the firm and there’s more money coming soon. We’re starting up easy street, Grace, thanks to you and the I. C. S.!”

Today more than ever before, money is what counts. The cost of living is mounting month by month. You can’t get along on what you have been making. Somehow you’ve simply got to increase your earnings.

Fortunately for you hundreds of thousands of other men have proved there is an unfailing way to do it. Train yourself for bigger work, learn to do some one thing well and employers will be glad to pay you real money for your special knowledge.

You can get the training that will prepare you for the position you want in the work you like best, whatever it may be. You can get it without sacrificing a single day or a dollar from your present occupation. You can get it at home, in spare time, through the International Correspondence Schools.

It is the *business* of the I. C. S. to prepare men in just your circumstances for better positions at better pay. They have been doing it for 28 years. They have helped two million other men and women. They are training over 100,000 now. Every day many students write to tell of advancements and increased salaries already won.

You have the same chance they had. What are you going to do with it? Can you afford to let a single priceless hour pass without at least finding out what the I. C. S. can do for you? Here is all we ask—without cost, without obligating yourself in any way, simply mark and mail this coupon.

### TEAR OUT HERE INTERNATIONAL CORRESPONDENCE SCHOOLS BOX 7678, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

- |                                                         |                                                  |
|---------------------------------------------------------|--------------------------------------------------|
| <input type="checkbox"/> ELECTRICAL ENGINEER            | <input type="checkbox"/> SALESMANSHIP            |
| <input type="checkbox"/> Electric Lighting and Railways | <input type="checkbox"/> ADVERTISING             |
| <input type="checkbox"/> Electric Wiring                | <input type="checkbox"/> Window Trimmer          |
| <input type="checkbox"/> Telegraph Engineer             | <input type="checkbox"/> Show Card Writer        |
| <input type="checkbox"/> Telephone Work                 | <input type="checkbox"/> Sign Painter            |
| <input type="checkbox"/> MECHANICAL ENGINEER            | <input type="checkbox"/> Railroad Trainman       |
| <input type="checkbox"/> Mechanical Draftsman           | <input type="checkbox"/> ILLUSTRATING            |
| <input type="checkbox"/> Machine Shop Practice          | <input type="checkbox"/> Cartooning              |
| <input type="checkbox"/> Toolmaker                      | <input type="checkbox"/> BUSINESS MANAGEMENT     |
| <input type="checkbox"/> Gas Engine Operating           | <input type="checkbox"/> Private Secretary       |
| <input type="checkbox"/> CIVIL ENGINEER                 | <input type="checkbox"/> BOOKKEEPER              |
| <input type="checkbox"/> Surveying and Mapping          | <input type="checkbox"/> Stenographer and Typist |
| <input type="checkbox"/> FIRE FOREMAN OR ENGINEER       | <input type="checkbox"/> Cert. Public Accountant |
| <input type="checkbox"/> STATIONARY ENGINEER            | <input type="checkbox"/> TRAFFIC MANAGER         |
| <input type="checkbox"/> Marine Engineer                | <input type="checkbox"/> Railway Accountant      |
| <input type="checkbox"/> Ship Draftsman                 | <input type="checkbox"/> Commercial Law          |
| <input type="checkbox"/> ARCHITECT                      | <input type="checkbox"/> GOOD ENGLISH            |
| <input type="checkbox"/> Contractor and Builder         | <input type="checkbox"/> Teacher                 |
| <input type="checkbox"/> Architectural Draftsman        | <input type="checkbox"/> Common School Subjects  |
| <input type="checkbox"/> Concrete Builder               | <input type="checkbox"/> CIVIL SERVICE           |
| <input type="checkbox"/> Structural Engineer            | <input type="checkbox"/> Railway Mail Clerk      |
| <input type="checkbox"/> PLUMBING AND HEATING           | <input type="checkbox"/> AUTOMOBILE OPERATING    |
| <input type="checkbox"/> Sheet Metal Worker             | <input type="checkbox"/> Auto Repairing          |
| <input type="checkbox"/> Textile Overseer or Supt.      | <input type="checkbox"/> Navigation              |
| <input type="checkbox"/> CHEMIST                        | <input type="checkbox"/> AGRICULTURE             |
| <input type="checkbox"/> Mathematics                    | <input type="checkbox"/> Poultry Raising         |

Name \_\_\_\_\_  
Present Occupation \_\_\_\_\_  
Street and No. \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_

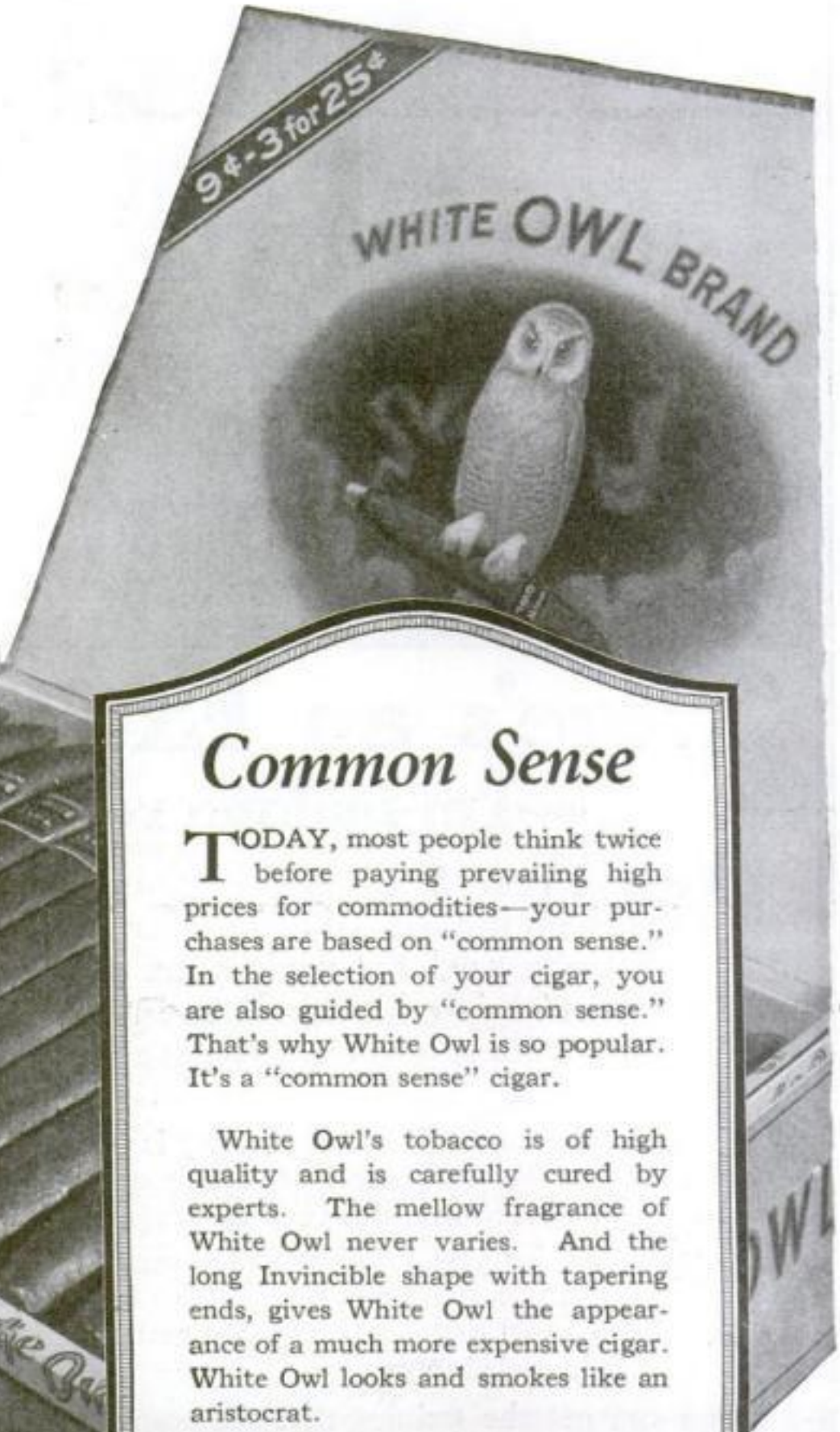
Canadians may send this coupon to  
International Correspondence Schools, Montreal, Canada





3 for 25¢  
1 for 9¢

Box of 50 for \$4.00



## Common Sense

TODAY, most people think twice before paying prevailing high prices for commodities—your purchases are based on "common sense." In the selection of your cigar, you are also guided by "common sense." That's why White Owl is so popular. It's a "common sense" cigar.

White Owl's tobacco is of high quality and is carefully cured by experts. The mellow fragrance of White Owl never varies. And the long Invincible shape with tapering ends, gives White Owl the appearance of a much more expensive cigar. White Owl looks and smokes like an aristocrat.

White Owl is guaranteed by the tremendous resources and long experience of the General Cigar Company, Inc.—facts which assure you of a good "common sense" cigar value. Besides, White Owl is hand-made and smokes evenly. Naturally, White Owl appeals to your "common sense."

*General Cigar Co., Inc.*

DEPENDABLE CIGARS

119 West 40th Street

New York City



# Popular Science Monthly

Waldemar Kaempffert, *Editor*

June, 1920; Volume 96, No. 6  
25 Cents a Copy; \$3 a Year



Published in New York City at  
225 West Thirty-ninth Street

## If the Eye Were a Telescope

We would enter a world of terrifying splendor at sunset

By Latimer J. Wilson

**I**F the human eye should suddenly acquire the power of a telescope, so that people could see everything magnified hundreds of times, what a strange sunset would end the day! As the dusk turned into the darkness of night, a pale light would flood the cerulescent sky, and the most remarkable of sights would be witnessed. Crowds would gather wherever an open view of the horizon could be obtained. Beyond the line of the ocean's rim would come a gigantic disk, so strange and mysterious that at first no one would recognize it as the moon.

Stupendous and terrifying, yet majestic in the lights and shadows of weird scenery, is the moon! If people could see the earth's satellite with the naked eye as even a moderate-sized telescope shows it, the strange beauty of Astarte would arouse mankind to its highest pitch of excitement and every hilltop would swarm with people who had come to witness the moonrise.

Magnified a hundred or more diameters, the moon would fill the sky with its

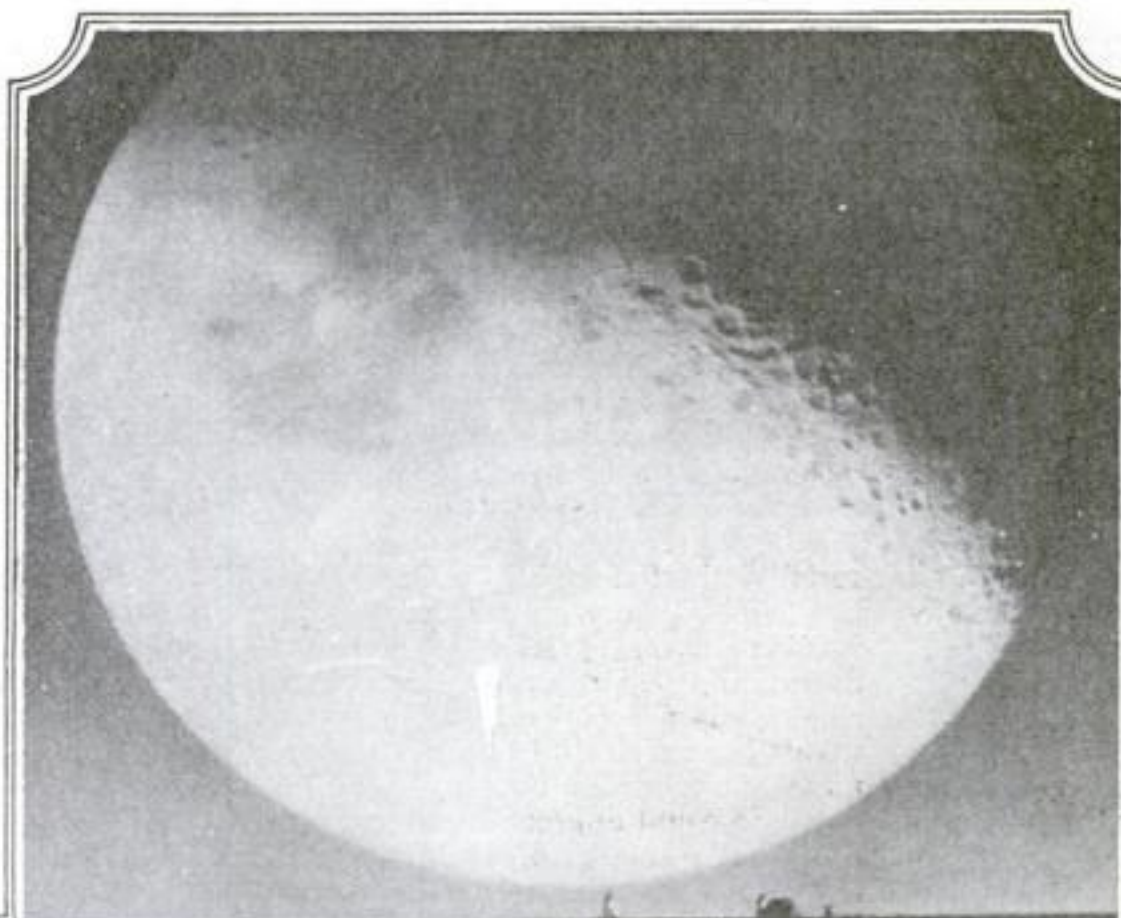
mountain-pinnacles and crater-walls hanging threateningly downward toward the earth. Men would distrust the power of gravity to hold such a mass of heavy material above their heads. The features of the familiar "moon man" would be transformed into arid plains pitted with black holes. Curious serpentine valleys, filled with shadows or brilliantly flashing the fire of sunshine; phantom peaks of mountains protruding from pits of bottomless night; crater-floors marked with fantastic shadows—the

eye as a telescope would disclose all these when we looked at the gibbous or the half or the crescent moon!

One normally thinks of the rising moon as a disk that is much smaller than a man of average height. But if a man should be seen projected against the disk of the moon when he stands a mile from the observer, he would appear only about one tenth of the diameter of the lunar disk, and he would be scarcely visible to the naked eye—unless it possessed the power of a telescope. If he stood closer he would

be proportionately larger, and if he were farther away he would be vastly smaller, in proportion to the huge hemisphere of the earth's satellite. To see the wonders of the heavens and to include the familiar features of the landscape, the observer would have to occupy a position that commanded a perfectly clear view. Otherwise near-by objects would intrude their magnified size upon the scene.

Having witnessed the moon rise and pass serenely across the



A strange light appears above the sea. There are silhouettes grotesquely wavering in the flowing currents of magnified air, through which the telescopic vision must penetrate. The light grows brighter and the gigantic disk of the moon appears





Rings of dust and meteorites surround the globe of Saturn. To see them without a telescope would be one of the greatest sights permitted the eye of man

heavens, the crowds would now behold a spectacle more fantastic than imagination has ever conceived. Every one could now see the splendor of Saturn, the ring-bound planet which before had been visible merely as a point of light shining steadily among the twinkling stars. This most beautiful of worlds comes into the sky in all the majesty of glittering moons and rings, scintillant in the light of the far-away sun. Says Omar:

From Earth's Center through the Seventh Gate I rose,  
And on the Throne of Saturn sate.

Yet the author of the Rubaiyat never saw the ring of Saturn as the telescope reveals it.

### *It Vanishes as You Draw Near*

At a distance of nearly 800,000,000 miles from the earth, the planet is a conspicuous object softly shining in the darkness of the night. But if one could approach close enough, Saturn would almost vanish, because its surface—so greatly magnified and spread

over so great an area of the sky—would be far less bright to one's eyes than when seen with its light concentrated upon a smaller area.

Saturn's ring is composed of small isolated bodies, each separately too insignificant to be individually seen from the earth. Meteoric dust-clouds, they circle swiftly around the equatorial girth of the planet. The bodies are evidently more scattered in that portion of the ring closest to the ball of Saturn and also in the outer rim of the ring, while a broad black gap occurs within the ring itself in which there are no visible reflecting bodies.

If one could approach very close to the great race-course of the ring, the little masses circling around it would be seen as mere dots of light, and the effect of the beautiful ring would utterly be spoiled. There are evidently vast clouds of tenuous dust, scarcely as dense as the haze of spring, which sweep back and forth across the rings as the forces of gravity and light-pressure operate. The moons of Saturn cause "tides" in

the ring particles and dust-clouds, producing what might be called gravitational waves, grinding together the denser masses, and passing in undulating motion throughout the plane of the ring.

### *Stars that Swarm by Thousands*

In certain parts of the heavens can be seen on a dark, clear night a mere hazy patch of luminosity, too faint to attract attention. If the eye were a telescope a marvelous transformation would occur when the observer glanced at one of these spots. Instead of the insignificant wisp of light, scarcely visible, would be seen a magnificent globular cluster of stars!

Hidden in the vast distance of space, these curious balls of suns are to be found. Literally thousands of stars are congregated in these mysterious swarms, and many of the individual members are variable in their light. They become alternately bright or faint in the course of only a few hours, flashing like lazy fireflies.





The magnificent cluster of stars in Hercules, which appears merely as a speck of light, but which to the eye of telescopic power would resemble a bursting rocket. Suns of many colors are in this swarm

in a summer night. If the eye possessed the power to disclose these amazingly beautiful objects, and people could see them associated with the landscape near the horizon, men would crowd every hill to witness the scene. A count of the exceedingly faint members of the sun-swarm might raise the total number in some of these clusters to 50,000 stars, the brightest streaming from the center in curious spiral arms. It is estimated that the light of one of these clusters is at least 37,000 years, traveling 186,000 miles a second, on its way earthward.

### *Like Rockets Bursting in Air*

Magnified a hundred or more times, the globular cluster becomes a truly impressive spectacle. Associated with the familiar landmarks on the distant horizon, and magnified many times, the great star-ball, which actually occupies an area in the sky scarcely one sixteenth the apparent space occupied by the full moon, would drop below the horizon like the myriad

sparks from a huge bursting rocket, astounding the spectators by its magnificence. "Can that mere speck of wispy light be that which I now behold?" would ask the spectator, comparing this telescopic object with its normal naked-eye view.

Turning toward another point of the horizon, a ball of light, a bright disk three or five times larger than the normal apparent size of the familiar fair lunar orb, could be seen. Shining like a star of dazzling beauty would be a curious white spot attached to the edge of the disk. It is the distinguishing feature of the most talked of planet, the earth's older neighbor in space, Mars. The white spot marks the polar snow of the planet.

With the passage of time men would become so accustomed to what the telescopic power of their vision disclosed that they would no doubt cease to marvel at what they saw. The magnified grandeur of the universe would become commonplace, but there would remain a wide and undiminished interest in the ever-changing phe-

nomena of Mars. The snow-caps, melting in the sunshine of the Martian summer or forming in whiteness during the winter, would ever attract attention. The delicate tints flashing like an opal in the sunlight, the sweep of seasons showing across the vast gap of millions of miles, would always make Mars a subject for newspaper publicity.

### *Enjoying the Martian Scenery*

If, without a telescope, observers could look at Mars and see its yellow deserts, its areas of blue-green forests and fields, its drifting clouds, and its regions of frost, if they could watch the strange shapes of the planet's markings as rotation brings them across the disk, the spectators would find such fascination in the views that people would speculate upon how to discover a means of finding out what manner of life prevailed there. The growth and decay of the remarkable streaks called "canals," thought to be projects of engineering skill producing an abun-



dance of vegetation by irrigating the desert regions of Mars, would be a fertile subject for newspaper controversy.

### *Bridges of Flame at Sunset*

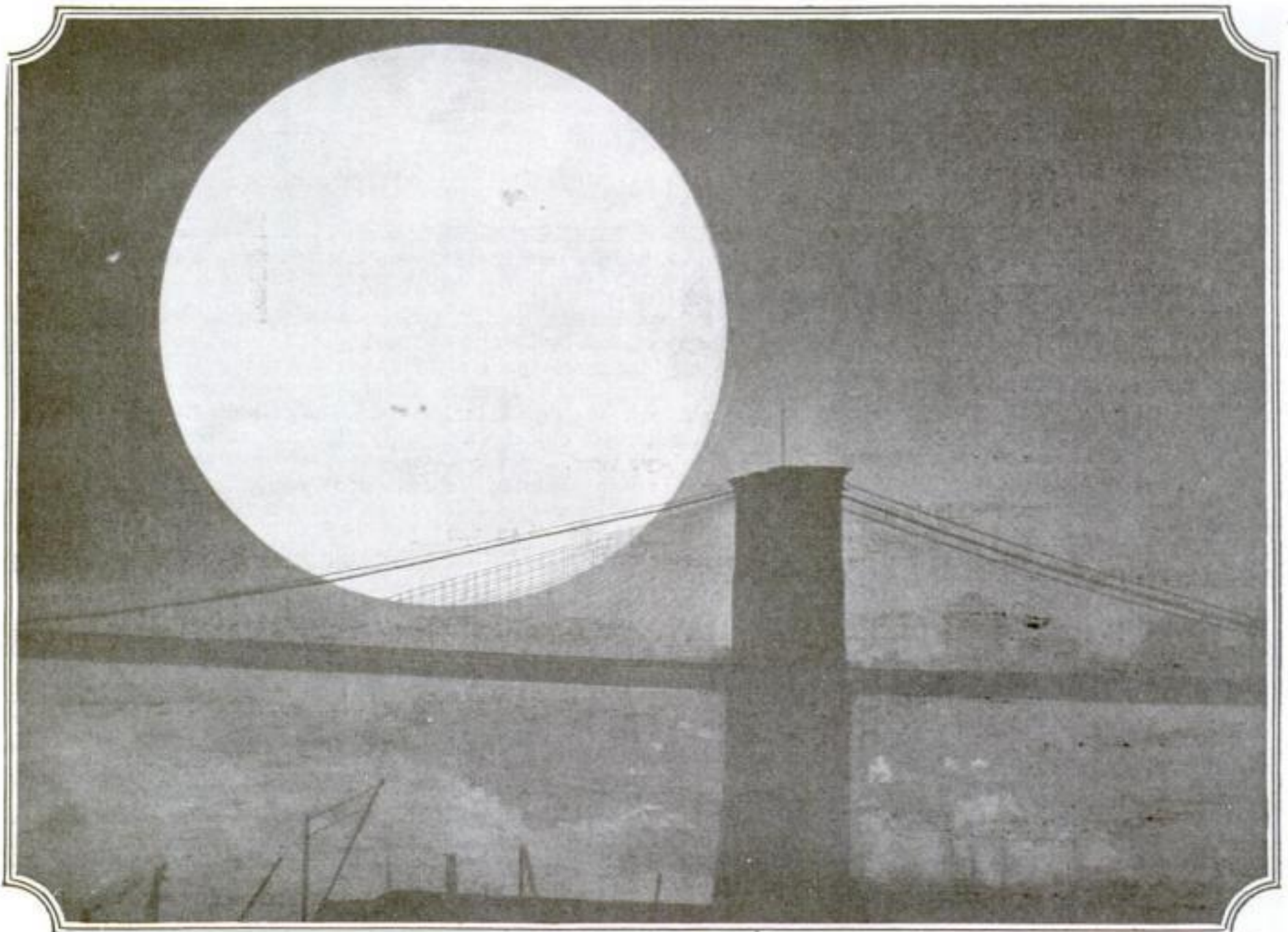
How strange would be the sunset! The enlarged sun, extended over a greater portion of the sky, would be less bright, area for area, than when concentrated in a smaller disk. But one would still have to use a shade-glass to look directly at it. Sun-spots, which are sometimes visible to the unaided eye, now could be seen as great fantastic shapes of darkness strung across the sun's bright disk.

Legend gives the buffalo's eye the power of magnification. But if the human eye took on the power of even a small telescope, to include landmarks, such as the Brooklyn Bridge, in the field of view, the observer would have to stand many miles away. Otherwise the bridge itself would eclipse the setting sun.

Man would view the sun, the moon, the star-clusters, and the planets magnified one hundred, four hundred, or one thousand times their naked-eye size. A new heaven and a new earth would be created for human sight.



From three to five times larger than the normal disk of the full moon, Mars, with its gleaming snow-caps, would be astounding if we could see it like this with the naked eye



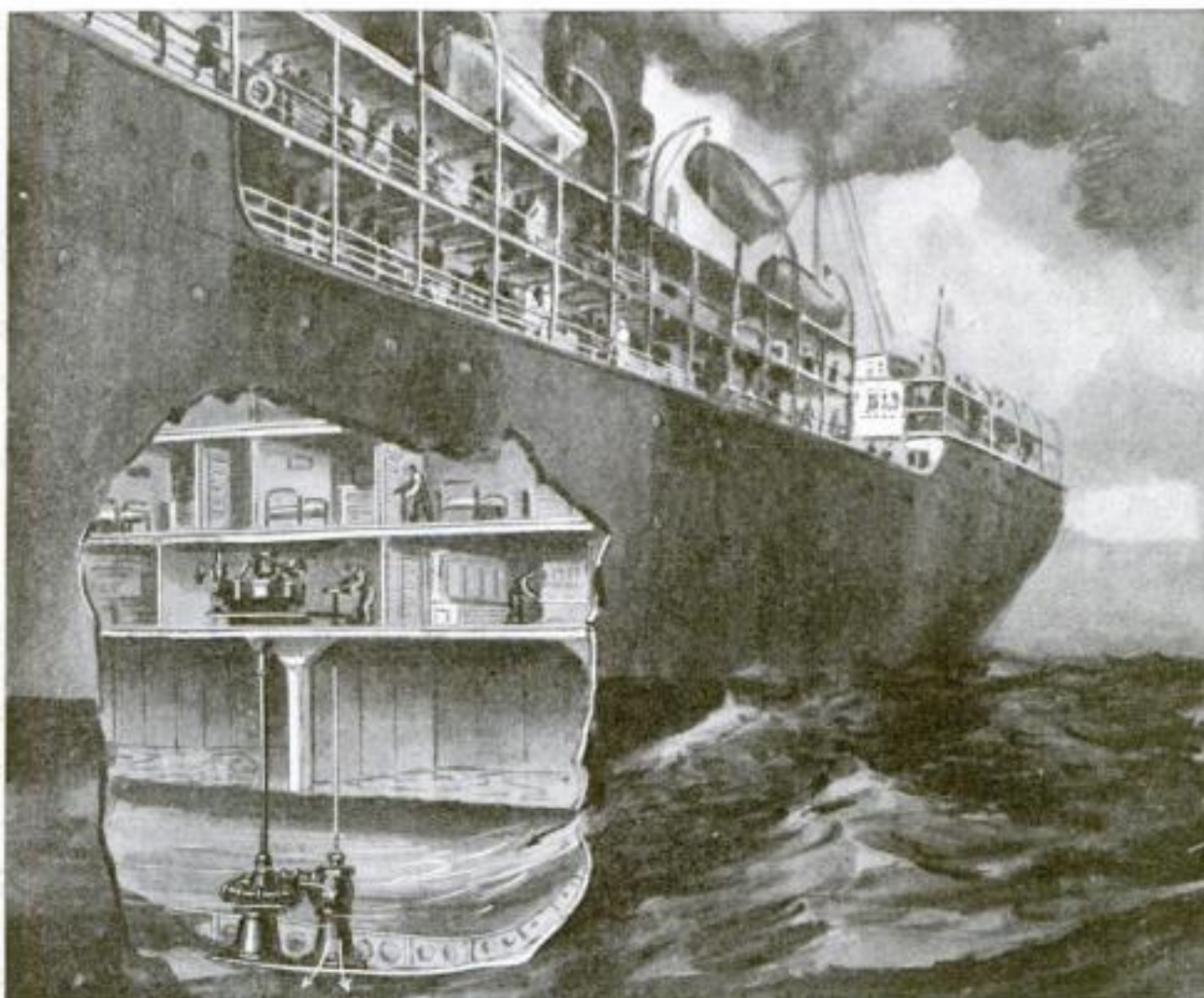
How the eye of telescopic power would see the gigantic sun. It would be too dazzling to view without a shade-glass. The observer's distance from the bridge would make it small enough to be included in the scene



## Submerge the Pump and Save the Sinking Ship

A SUDDEN violent shock causes the ship to tremble. Soon the pumps of the great liner are set to work, trying to pump out the water from the ship's hold faster than it pours in through the rent in the vessel's side. Which will win?

If turbine-driven bilge-pumps have been installed throughout the vessel, there is a good chance that the rush of water pouring in will soon be outdone by the work of the pumps. Then repairmen will patch up the ship at least



Water can't drown out this pump, which, working while submerged, gives a new chance to ships with sides rent by collision at sea

sufficiently to make port.

The pump consists of a turbine driving system, power for which is furnished by gasoline, steam, or electricity, the turbine being operated above the submerged compartments while the pump itself is submerged. The water passes through openings near the base of the pump, and swiftly revolving vanes create a vacant space, into which the water rushes, to be expelled by the centrifugal force and sent through an outlet in the ship's bottom.

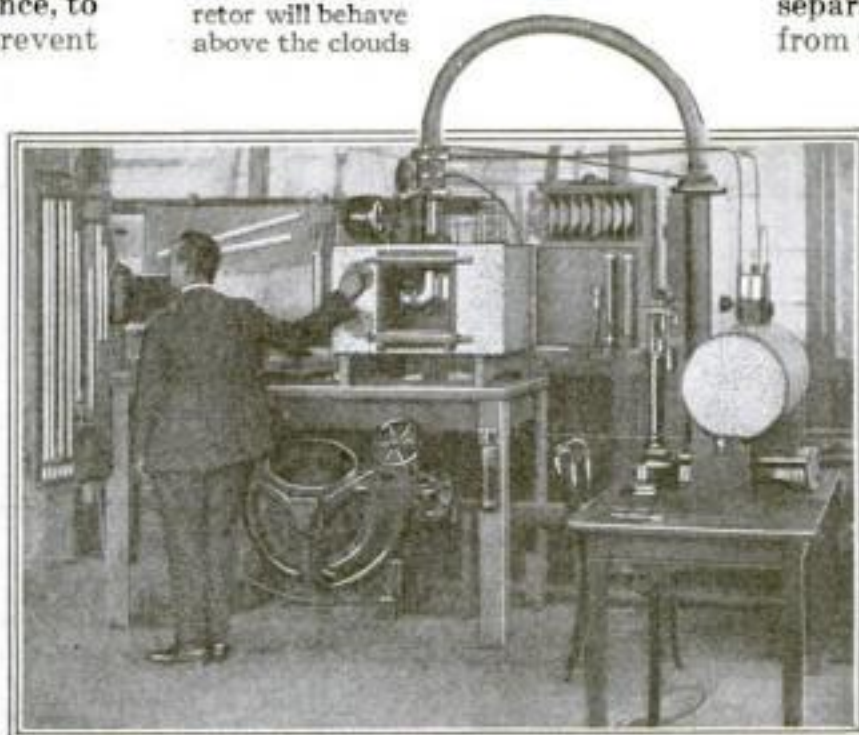
## "Reaching the Ceiling" on the Ground

WHEN an airplane has reached the highest altitude that is possible for it, it is said, in aviators' parlance, to have "hit the ceiling." To prevent airplane engines from balking at the conditions usually encountered high in the air, the Bureau of Standards has developed a remarkable testing apparatus. In the laboratory are artificially created "altitude" conditions, so the carburetor of the airplane engine can be properly given rigorous trials.

The decline, in the course of recent years, in the quality of gasoline has thrown a constantly increasing strain upon the carburetor of the gas engine. An automobile taken from sea-level to work upon a high mountain is likely to develop curious ailments unless forethought has provided a carburetor that will function as well eight or ten thousand feet above sea-level as it will in the lowlands.

When airplanes fly into the region of thin air, the engine acts somewhat as does the human heart when it is suddenly carried into a reduced density of atmosphere: it thumps violently against the lessened resistance. There-

Discovering in the laboratory how a carburetor will behave above the clouds



fore, in the case of the engine as well as in that of the heart, strict attention must be given in advance to make sure that it is strong enough to adapt itself to the change.

The Bureau of Standards has created all of the conditions that the carburetor is likely to meet in passing from dense air at sea-level into the thin

atmosphere above the six-mile altitude. To avoid the complication of separating the carburetor troubles from those of the rest of the engine, the

tests are arranged for the complete isolation of the carburetor. It really is the equivalent of taking this part of the engine upon a fanciful trip where all the conditions of the upper levels are encountered.

The carburetor is mounted in a small chamber where it is possible to alter the atmospheric pressure at will. Air can be drawn out with vacuum pumps until only a quarter of the normal pressure prevails, and it can be increased to a far greater pressure. In this altitude chamber the duties of all kinds of work, under every conceivable condition, can be

imposed upon the carburetor and its performance observed.

An engine must stand the severe conditions due to the rapid change from lower to higher altitudes. The engine is the airplane's heart, throbbing violently when conditions are abnormal. Laboratory tests will enable the mechanical "heart" to stand the strain.



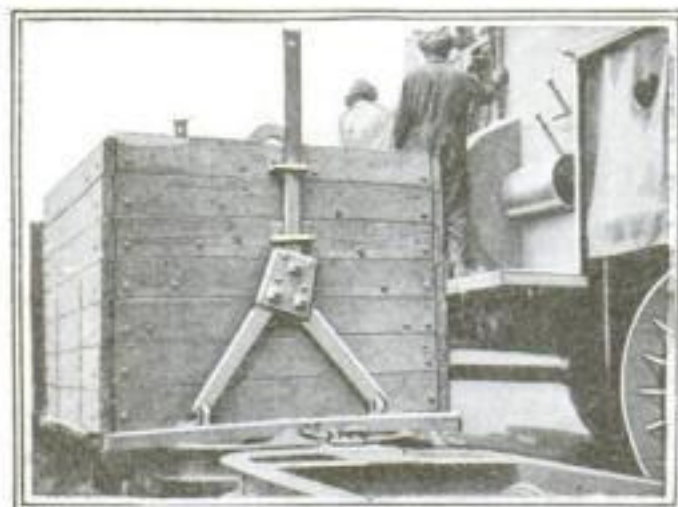
## Good Roads at a Mile a Week

**A**N enterprising contractor decided that, instead of building cement roads at the rate of one mile a month, he would build them at the rate of one mile a week. To do this he maintained a "material-yard" in which the road-making material was arranged systematically. Then he built a track along which strings of cars carrying large "batch-boxes" could be drawn from the yard to the cement-mixer.

A locomotive crane handled the material, and the box train was pulled to and from the paving scene, a progressive transportation of the material taking place. The huge boxes, each having a capacity of 55 cubic feet, first were loaded with the necessary amount of stone. Then they passed on to the cement hopper, where the re-

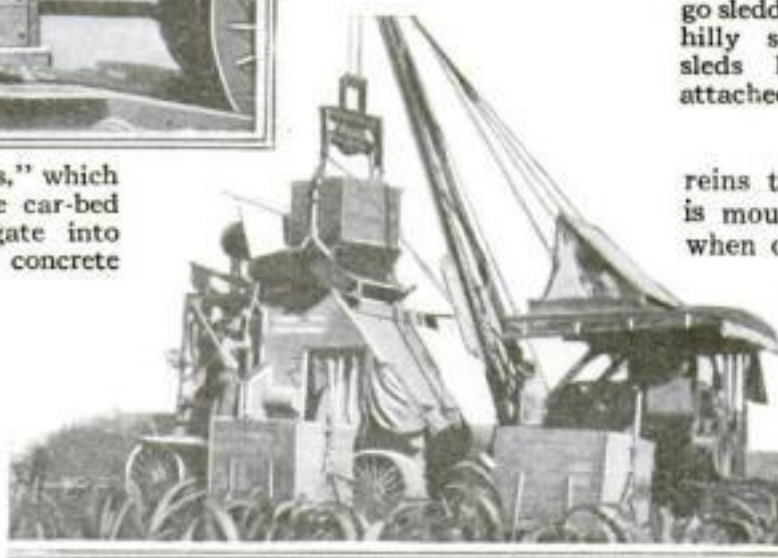
quired amount of cement was admitted through a metal cylinder holding 5 cubic feet, and so arranged that it could be filled and emptied until enough cement had been added. After this the cars were shunted to the sand-hopper and the proper proportion of sand added to the stone and cement. The train of fifteen cars was then sent out to the concrete-mixer.

Wheels four feet high with a 20-inch tread enabled the gigantic concrete-mixer to be moved from place to place as the work advanced. The mixer stood 16 feet high, and a 35-horsepower engine furnished the power to mix 28 cubic feet of concrete to each batch of the aggregate, weighing more than two tons.



One of the great "batch-boxes," which can be easily lifted from the car-bed to empty its load of aggregate into the mixer to be made into concrete

One of the locomotive cranes dumping a "batch-box" into the hopper. It is the use of these great boxes, weighing more than two tons each, that made the speed of a mile a week in road-building a reality



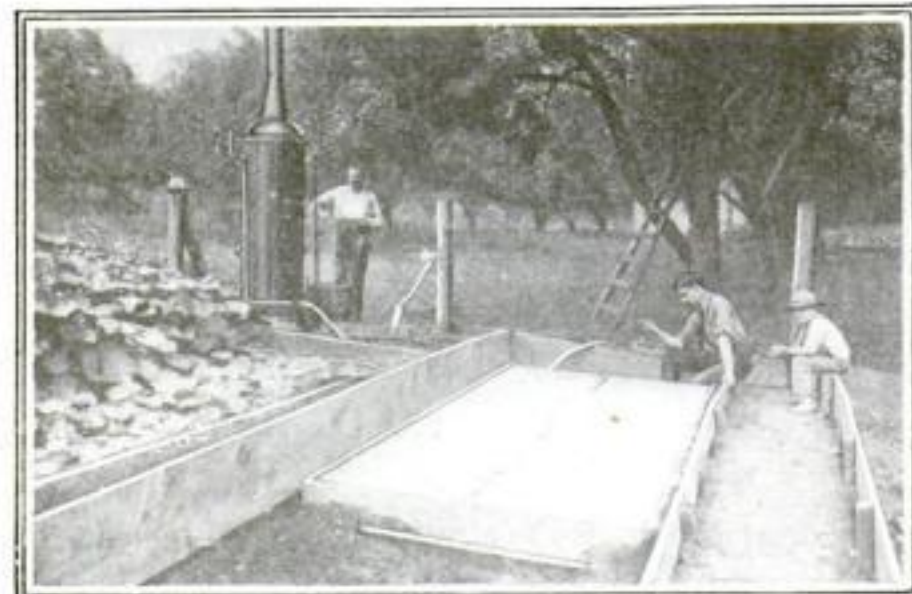
## Killing Weeds by Steam

**I**F the anti-tobaccoists don't put one over on us some fine day in the near future, then the new tobaccoseed-bed sterilizing process will come into its own. Heretofore the seed-beds have been freed from weeds and undesirable growths by fire. Large quantities of brush were

burned on them. But in the new method sterilization is accomplished by steam.

A large pan about four inches deep, having a steam-boiler connected with it, is necessary. The pan is turned upside down and sunk into the bed. Then the steam is turned on. A boiler that will furnish a supply of 25 horsepower should be used in connection with a pan that measures six by twelve feet. A smaller boiler necessitates a smaller pan. The pan may be made of wood, but the joints should be smeared with white lead to prevent the possible escape of steam.

The sterilization of one thousand square feet of plant bed will cost approximately six dollars, since half a ton of soft coal will do the job.



Tobaccoseed-beds are now sterilized by steam; a steam-boiler and a shallow pan, inverted, will do the job



## Coasting on the Summer-Winter Sled

**D**RESSED in a straw hat, a long veil, a middy blouse, a long skirt, and a pair of flat-heeled shoes, a Viennese maiden takes out her sled. Why the summer outfit? The answer is simple: it is summer.

Her sled—as you will see if you study the picture on the left—is equipped with three rubber-tired wheels that enable her to slide down hills with it in summertime as well as in the winter. Of course, when there's snow on the ground she takes the wheels off.

She steers the sled by means of reins that turn the axle on which the front wheel is mounted. The rubber tires make riding easy—except when one of them gets punctured.

© Press Illustrating Service

Though it is summer in Vienna, the people go sledding down the hilly streets; their sleds have wheels attached underneath

## Safety First for Experimenters in Kite-Flying

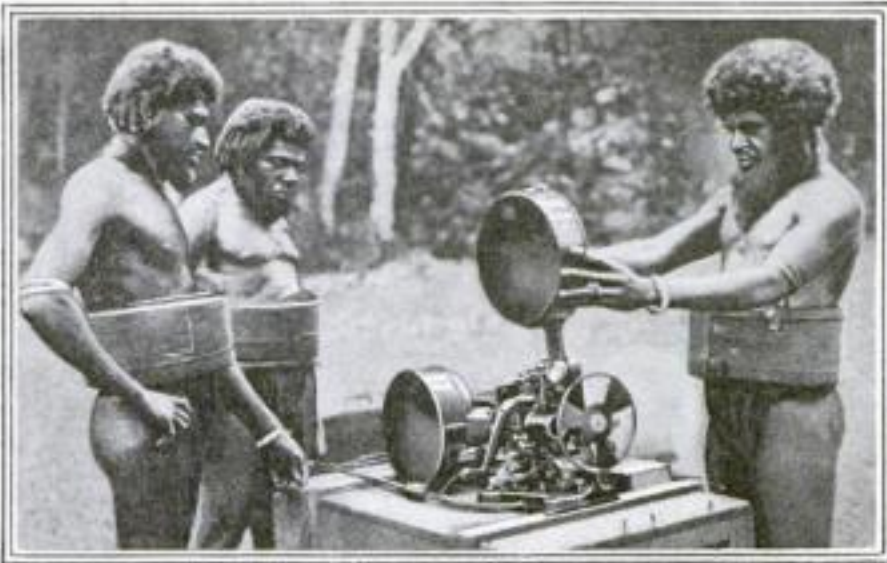
**P**OWERFUL forces are hidden in the invisible realm of the atmosphere, which occasionally make themselves known in a highly dangerous manner. When Benjamin Franklin made his wonderful discovery, using a metal key and a kite-string to bring the electricity from the sky, the wonder is that he was not electrocuted in the daring attempt.

A wet kite-string is a good conductor, making the static discharge between cloud and ground easy. Experimenters flying kites with metal "strings" stand a far greater chance of bringing down the lightning, even when no cloud is in sight. Last August a man was killed when standing near a kite-string of wire while a kite was being reeled in. He held a piece of wire in his hand at the time. A series of bright sparks suddenly ran up the string, and the whole length of the kite-wire, more than a mile, was instantly fused. A scar was burned on the victim's chest, and there was a severe burn on the inside of his wrist.

While these accidents are rare, the fact that they do occur should warn kite-fliers of the possible danger. But during the period of about twenty-five years in which the Weather Bureau has engaged in kite-flying this is the first accident of its kind that has occurred.

A dark cloud does not have to be in sight to warn the men who make use of metal kite-strings. Static electricity is always present, and if the kite is sufficiently high to act as a conductor, then look out for the flash.





Natives of Malekula Island examining a motion-picture machine. They attributed the projected pictures of themselves to magic

## As Cannibals See Themselves

TWO years ago Mr. and Mrs. Martin Johnson risked their lives on Malekula Island taking motion pictures of the savages. They were captured by the vicious chief Nagapate, and had to run for their lives, just managing to effect an escape. But later these intrepid explorers made another trip to the island, and this time they were

received like royalty. What brought about the change of heart of the cannibal king?

Mr. Johnson took with him a generator to furnish the light for a motion-picture projection machine. He hung up a screen between the palm trees, and in the starlit night of the southern seas he exhibited, under the protection of an armed guard, motion pictures of the natives themselves.

So amazed were they at seeing their past actions thus preserved that they immediately set the whole thing down as a work of "devil magic" too astonishing to be combated. Therefore they figuratively handed over the keys of the island to the white explorers, and the chief personally led them about from tribe to tribe, openly boasting that he had brought them there.

## Gliding Down a Thousand Feet

IT was a curious airplane that started downward on a thousand-foot drop. There was no one in it to steer it to safety, yet it landed gracefully.

"But what about the danger to people on the ground when an airplane comes unguided to land? Haven't pedestrians any rights at all?"

There is no danger when the airplane is only a model not large enough to carry a pilot.

In a contest of flying models held recently in the city of Los Angeles a strange type of flier was taken up to an altitude of about one thousand feet and released. A crowd watched it from below, and the model was seen to spin around for a moment, caught in the "wash" of the propellers of the big machine. Then it became stable and gracefully began its long glide of more than a mile. With the greatest interest the crowd watched it through glasses until it drew close enough to be observed with the naked eye. A while later a great shout greeted the strange little airplane's perfect landing.

This biplane model differs in one important particular from ordinary airplanes, the invention of this type being accredited to

Mr. Edwin G. Gettins. In the ordinary biplane the wings are open at the ends and ailerons are relied upon to furnish stability. In the new model the frame at the end of the planes is arranged somewhat in the form of a truss.

The planes are closed at the ends by the crossing of the top and bottom plane, the top plane bending downward and the bottom plane bending upward.

Tipped one way or another by the sudden onslaught of a current, the flow of the air is controlled by the lines of the crossed section and the plane is stabilized.

The model of a new type of airplane is here seen rising rapidly against the wind. It will be noticed that the tips of the planes are bent in a peculiar way that gives stability to the model



## How the Worm Gets in the Hazelnut

WHERE did the worm in the hazelnut come from? That question has puzzled many a boy. He knows that the nuts he gathered were carefully culled and that none were stored that gave any evidence of being unsound. And yet, a few months later, when he begins to crack the nuts, he finds that a surprisingly large number are wormy.

Where did the little fat white worm come from?

The worm is the larva of a strange-looking insect known as the hazelnut weevil, an insect that belongs to the same family as the much-dreaded boll-weevil, which is periodically so destructive to the farmer's grain.

As will be seen in the illustration, the insect is provided with a long, slender proboscis, or snout, at the extremity of which is seen a peculiar hooklike appendage. The proboscis is a modification of the mouth parts, and but for this snout the worm would never find its way into the nut.

In the late summer, while the nut is still green and tender, the mother weevil goes in search of a place to lay her egg. The egg must be kept safe from harm during its incubating period, and when the larva hatches, it is highly important, from the weevil's point of view, that there be food close at hand so that the baby weevil will not die a prematurely early death.

Instinct has taught the mother weevil that no better place could be found for her egg than the inside of a hazelnut, for there lies safety for her egg and food for her offspring. So the mother weevil begins to peck away with her queer-looking snout, and in due time she has made a tiny tunnel to the center of the nut. Then she lays an egg, poking it well down into the tunnel with her snout.

In a short time nature closes the opening and the egg lies safely within, finally hatching into a little white grub. The grub finds food aplenty and grows fat and rotund.

When the food is all gone and he is full grown, the baby weevil gnaws his way out of the hazelnut that has sheltered him and is ready for the second step in his development, that all-important step which will transform him into a weevil exactly like his mother.

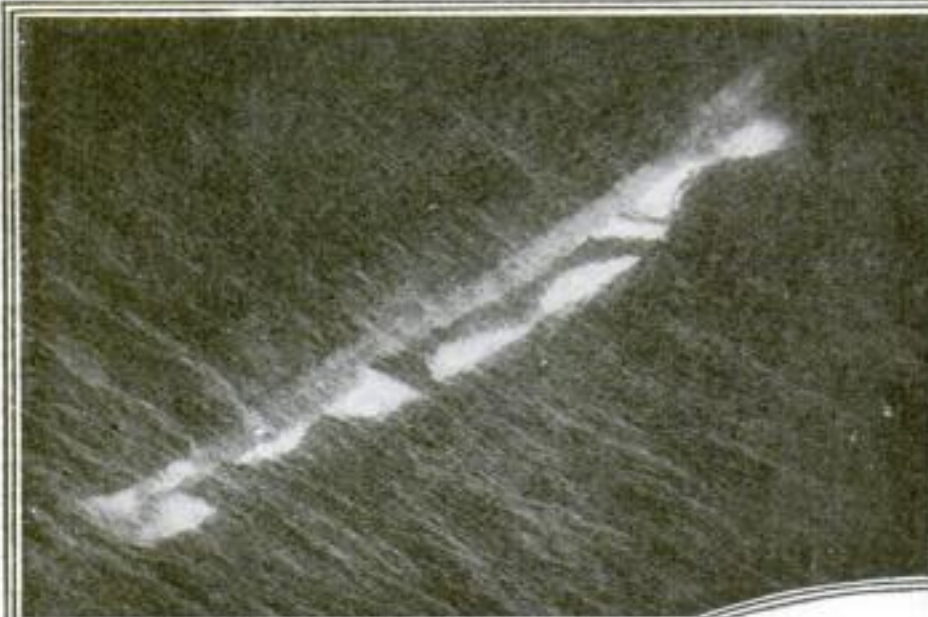


Mother weevil pecks at a green hazelnut and deposits her egg in the center; when it comes to life it ruins the nut



# Peace-Time Jobs for Aerial Photography

Photographs by courtesy of Dr. Herbert E. Ives, from "Airplane Photography" (J. B. Lippincott Company)



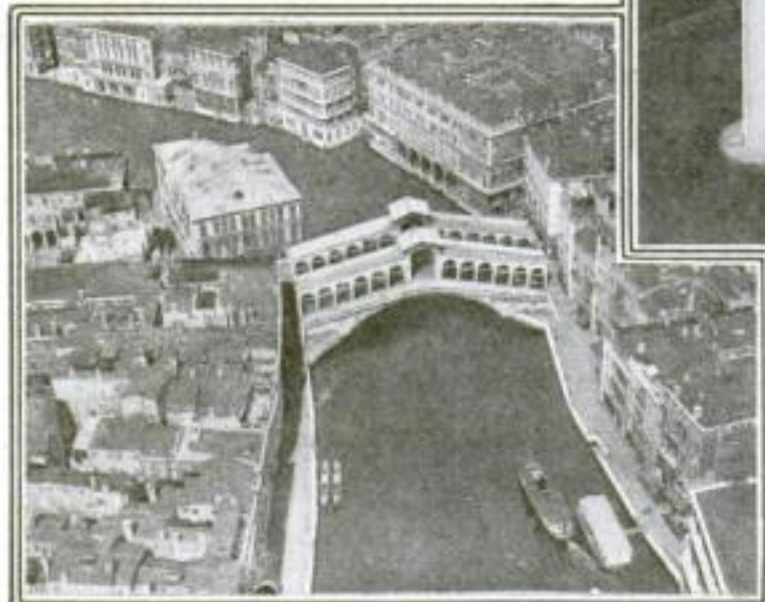
That white streak across the water is the shadow cast by a wrecked merchant steamer twelve fathoms deep. During the war airplanes were used for locating submarines; now they are used for locating sunken ships

Did you realize that "soap-suds," made by a ship moving through the sea, spread over so much water? Photographs like this, indicating how various ships take the waves, greatly assist the naval architect

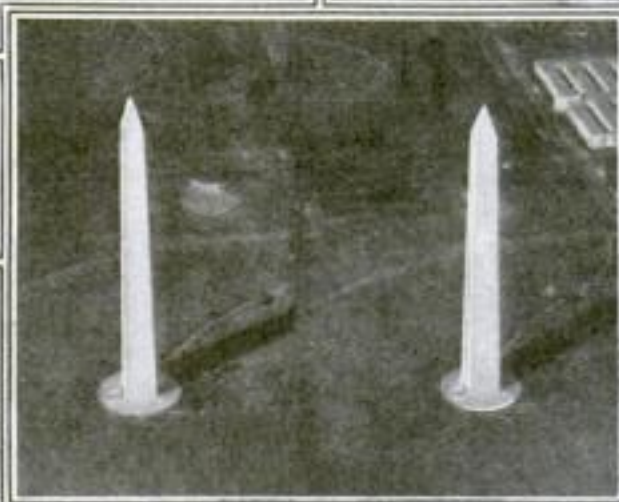


In taking pictures from a high altitude, a haze filter is almost always necessary. This picture was taken at an altitude of 10,000 feet with no filter—the haze blotted out the territory

The same territory was photographed through an orange filter—see how plainly it stands out? Filters are usually made of thin sheets of gelatine, dyed, and mounted in front of the film



If you can't afford a trip to Venice—the "Bride of the Adriatic"—at least you can attend a lecture on it. Travelogue lecturers are now exhibiting aerial photographs like this one of the Rialto bridge



Two stereoscopic views of the Obelisk at Washington, D. C. They were taken with a ten-inch focus camera provided with a two-aperture focal-plane shutter. The two exposures were made a few seconds apart. Such double pictures are designed for use in a stereoscope (see the one pictured above)

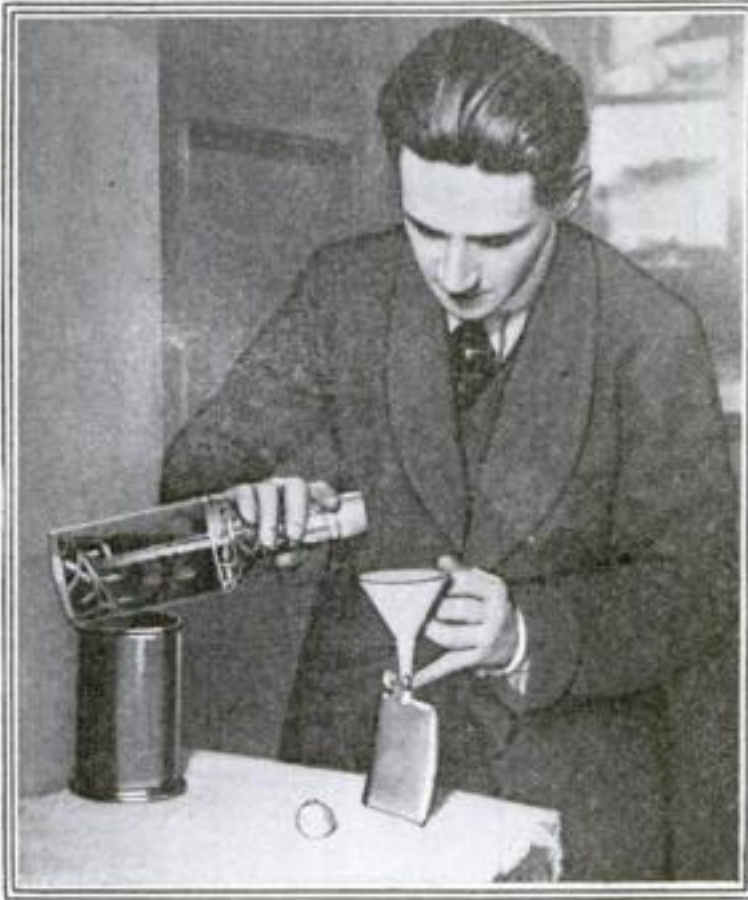


The explorer, the geologist, the geographer, and the map-maker will find airplane views of the greatest help. The whole town of Bengazi, North Africa, is clearly shown in this picture, taken by an Italian aviator



# Where There's a Thirst There's a Way

Photographs © Kadel & Herbert



He never truly appreciated his silver cigarette-case until now. By soldering up the sides and leaving a small opening in the top he can carry around a man-sized drink.

The kerosene and lard that once inhabited this can and tub never dreamed that they made way for a still. Stills are illegal, but if you take some raisins and other things—



He used to keep "it" on his hip, but now he pours "it" into a rubber tube. Does he really think no one will guess why he wears that tube?



Canes are not always what they seem. Sometimes they contain umbrellas and sometimes they contain (y-h-h-h) whisky!

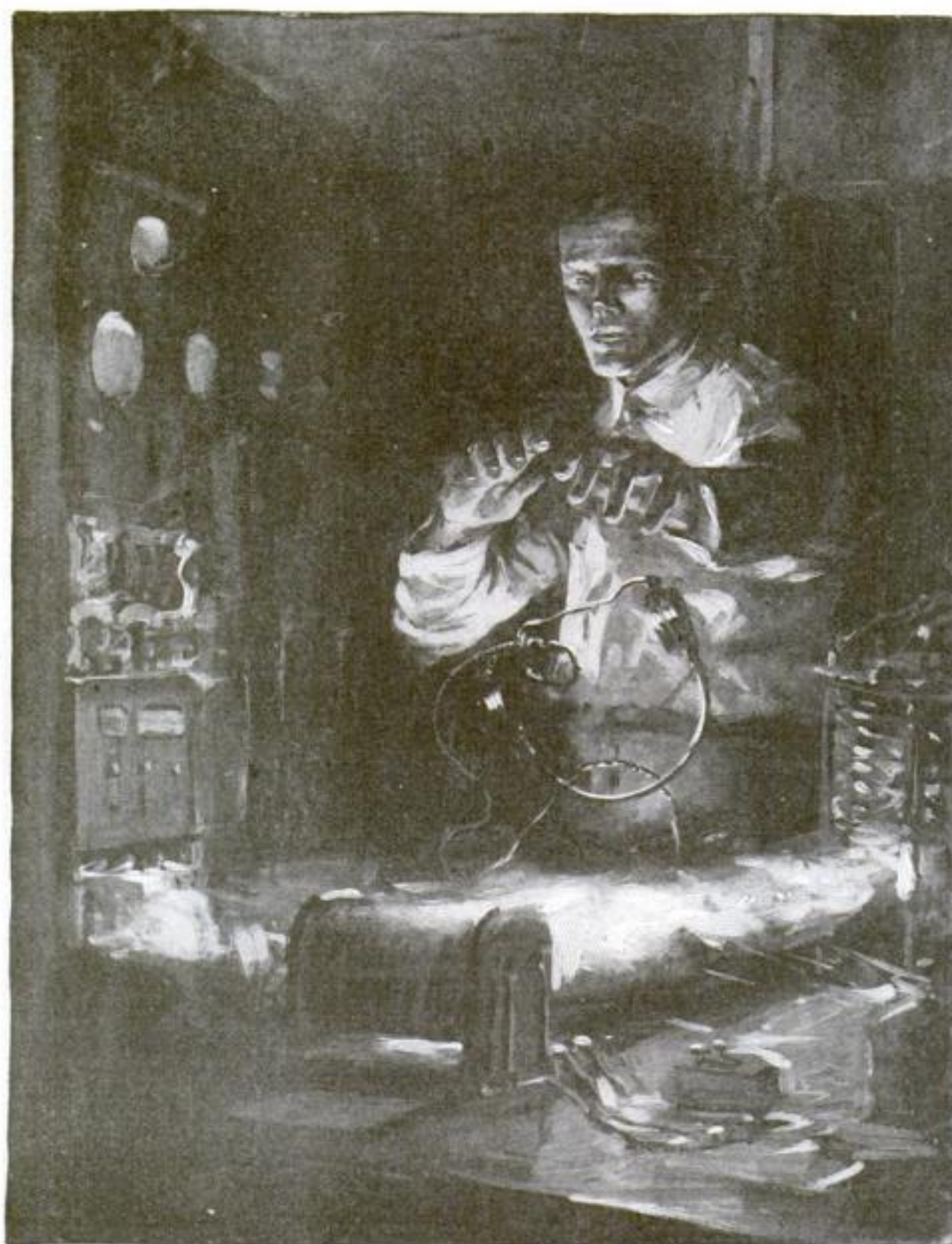
How those Federal officers do gloat when they tear apart some poor old can and find unlawful liquor within! These aged turpentine cans, shipped from Havana, hold saw-dust and—Scotch



Formerly he filled his inner tube with "free air"; now he fills it with valuable liquid. What would occur if he should happen to have a blow-out just as he crossed the Canadian border on his way into our dry country?







Out of the flaming electric arc there came a human voice; there was part of a broken sentence, then the flame snapped out and the voice with it

## A Voice Spoke from the Storm

But the startled hearer found a scientific explanation of his uncanny experience

**A** VOICE out of the night and the storm.

The voice fell on ears that knew there could be no one to utter the call. It was a voice apart from all human relationship. The hearer confesses that his flesh seemed to creep and thrill.

And yet, it was the day of the material present and not the eery time of ghost and goblin. The place was East Lansing, Michigan, and not the domain of witches.

It is Professor Herman Vedder, of the engineering department of Michi-

gan Agricultural College, who relates the experience. Those who remember their Jules Verne will remember the thrill with which they read of the message that came over the telegraph line to which it was supposed no one could have access except its makers. Professor Vedder's experience was like that, only the chance of human agency seemed even more remote.

The circumstance was related by the professor to a group that had remained following a meeting of the Lansing Engineers' Club at the college, and was discussing some phases of a

lecture that had just been delivered on advanced theories of electrical science. The group had been chatting informally, and the conversation led up to the experience told by Professor Vedder. Someone had just said that the physical seemed to taper off into the super-physical.

The circumstance in question occurred back in the days when wireless telegraphy was under the close observation of students and investigators, before antennae were strung from the house-tops of experimentally inclined boys. Professor Vedder was a student of the new wonder.

On the night in question Professor Vedder was sitting over his instruments, in a crashing thunderstorm. How wireless would act, with the heavens surcharged to the limit with electricity, was the matter under observation. Presently, however, prudence dictated withdrawal.

"I drew back hurriedly from my apparatus," said the Professor. "A flash of lightning ripped into my station, and across one of my instruments there blazed a flaming electric arc. Out of the flame came a human voice—I heard part of a broken sentence. It lasted for an instant. Then the blaze snapped out and the voice ceased.

"It was some time afterward that the explanation was worked out. You perhaps know that an arc light responds to the resonant effect of the human voice. What is known as the 'singing arc' is well known to physicists. That is, a telephone circuit is introduced into a current supplying an arc light, and out of the arc word vibrations can be made to come.

"Now, on the occasion of which I speak, a sudden flash of lightning had formed an arc across part of my apparatus. This circumstance befell just at the time the telephone wire leading from the home of one of the other professors had been blown by the storm across my wireless aerial. The voice was that of the professor's wife, who was attempting to telephone the grocer. Later she told me what she had said, and the words I had heard fitted in with her sentence. But the first unexplained effect was most uncanny."



# Nature Presents Her Gas Bill

And it's a big one because we must pay for tremendous waste

By Calvin Frazer

**E**VERY year the American people pay out millions of dollars for the natural gas they don't get.

When a town in the gas belt is forced to turn from natural to artificial gas because the local supply of the former is exhausted, the citizens of that town are put to heavy expense in reconstructing the heating and lighting arrangements of their homes, stores, and factories. This happens, on an average, in fifteen American towns each year. Incidentally, an added strain is placed upon the nation's coal supply, and we all pay a little more a ton for coal. When a number of steel plants and glass works are forced to turn from natural gas to coal, we all pay a little more for steel and glass. In such ways nature is presenting her belated bill for a commodity that we once thought was as free as air and water. We are paying for the gas we don't get, and, to make matters more exasperating, we are paying for billions and billions of cubic feet of this precious fuel that we never *did* get, because it was deliberately thrown away after being brought out of the earth.

A long time has passed since we learned by bitter experience that the supply of natural gas is really limited; yet the colossal waste still goes on. According to estimates recently prepared by the Fuel Administration, the amount of natural gas wasted in the United States in the year 1917 was equivalent to \$1,200,000,000 worth of artificial city gas.

## How Gas Is Wasted

Here are a few of the many ways in which natural gas is wasted:

Gas is always found at oil-wells, and only a small percentage of this gas is ever turned to account. It is a common practice of oil operators to blow off the gas in order to procure the oil. Many fine gas-fields have been depleted by this process. It is stated that the oil-wells of West Virginia alone are thus wasting annually at least seventy billion cubic feet of natural gas, equivalent to about one third of all the natural gas used for domestic consumption in the United States. At both oil and gas-wells gas is wasted through improper casing of the bore-hole, improper plugging of abandoned wells, and in various other ways.

Natural gas that is captured and piped to the consumer is very rarely used to the best advantage. Under



© Courtesy Hercules Powder Co.

The gas-well was on fire! A flame by day and night, visible many miles away. It leaped 200 feet in the air, permitting 190,000,000 cubic feet of gas each day to be consumed

stress of competition the gas-fields are over-produced, and the underground pressure of the gas is soon disastrously lowered, often resulting in the invasion of the wells by water. The old practice of selling natural gas at a flat rate of so much to the consumer, or at so much to a fire or other fixture—no meter being installed—survives in many places, thus putting a premium on waste. "Boom" towns still lure the manufacturer by offering gas for nothing, or at a ridiculously low rate. Wasteful open-flame torches, or *flambeaux*, are still found in the gas belt.

There are two salient features of the situation that seem not to have been generally realized until recently. One is that natural gas ought not



© Courtesy Hercules Powder Co.

The same gas-well fire as it looked at night. Great fires like this can be extinguished only by dynamite exploded in the air at the side of the flame

to be used for industrial purposes at all. It is an ideal fuel for the household, and, where the domestic consumer might enjoy an ample supply at a very low cost for generations if the gas were all allotted to household use, the demands of factories soon result in the decline and failure of even the richest gas-fields, so that both householder and manufacturer are driven to using a far more expensive and less convenient fuel. The other important lesson to be drawn from the history of this industry is one directly opposed to the existing attitude of the government toward unity of action among the operators. Competition leads to stupendous waste. Pooling of operations should be not only permitted, but encouraged or made obligatory.

## A Source of Gasoline

Natural gas is a blessing that brightens as it takes its flight. To-day, when all the world is clamoring for gasoline, we know that our rapidly-waning store of natural gas is one of the readiest sources of this substance. Nearly all natural gas contains gasoline vapor. The gas that issues from oil-wells, known as "wet" or "casing-head" gas, contains upward of three fourths of a gallon of gasoline to each 1,000 cubic feet of gas. The natural gas obtained from gas-wells is rela-



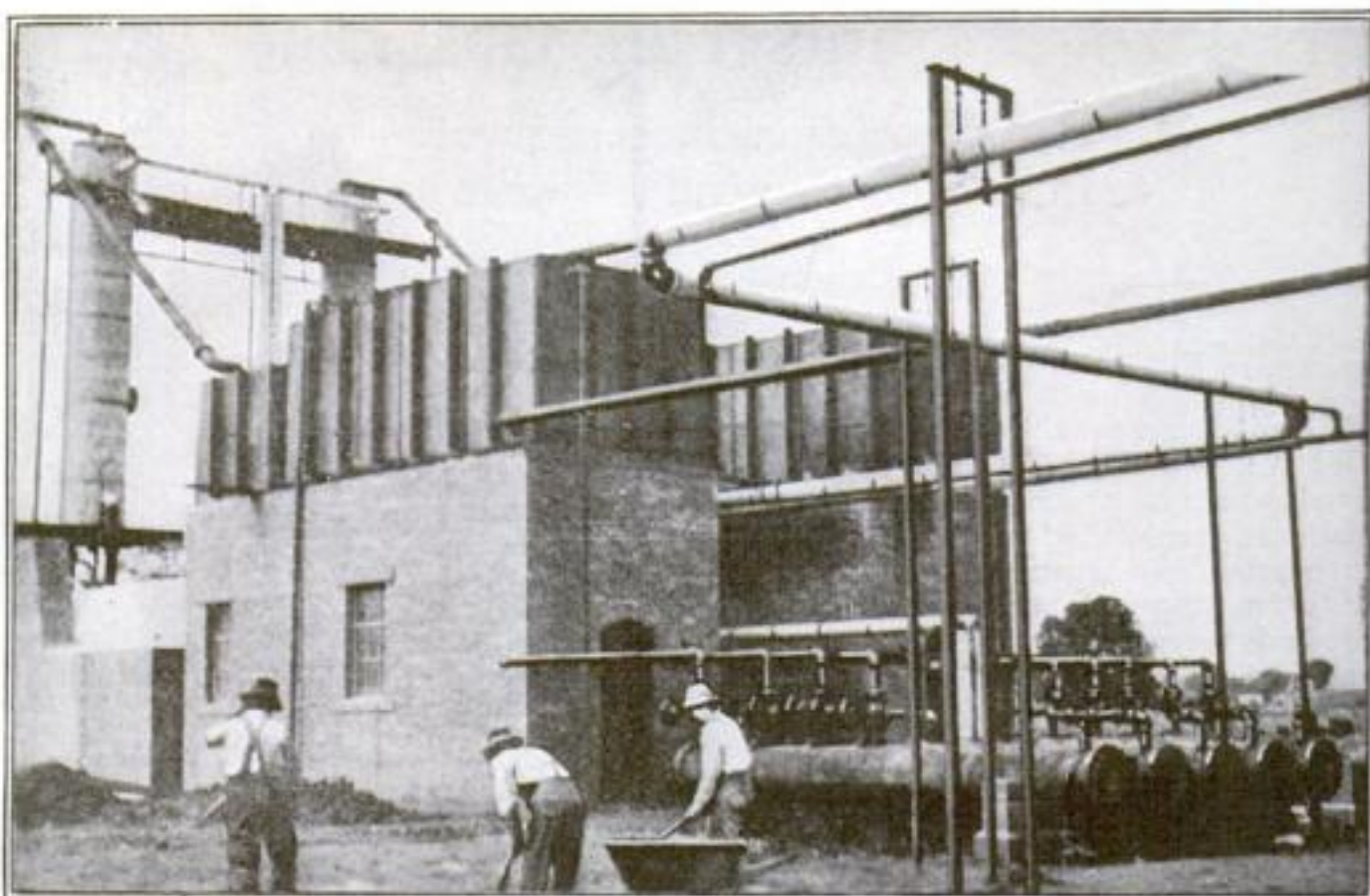
tively "dry" or lean in gasoline vapor; yet it carries enough of this ingredient to cause serious trouble along the pipe-lines, in which the condensed gasoline decomposes the rubber couplings.

### Unappreciated Gasoline

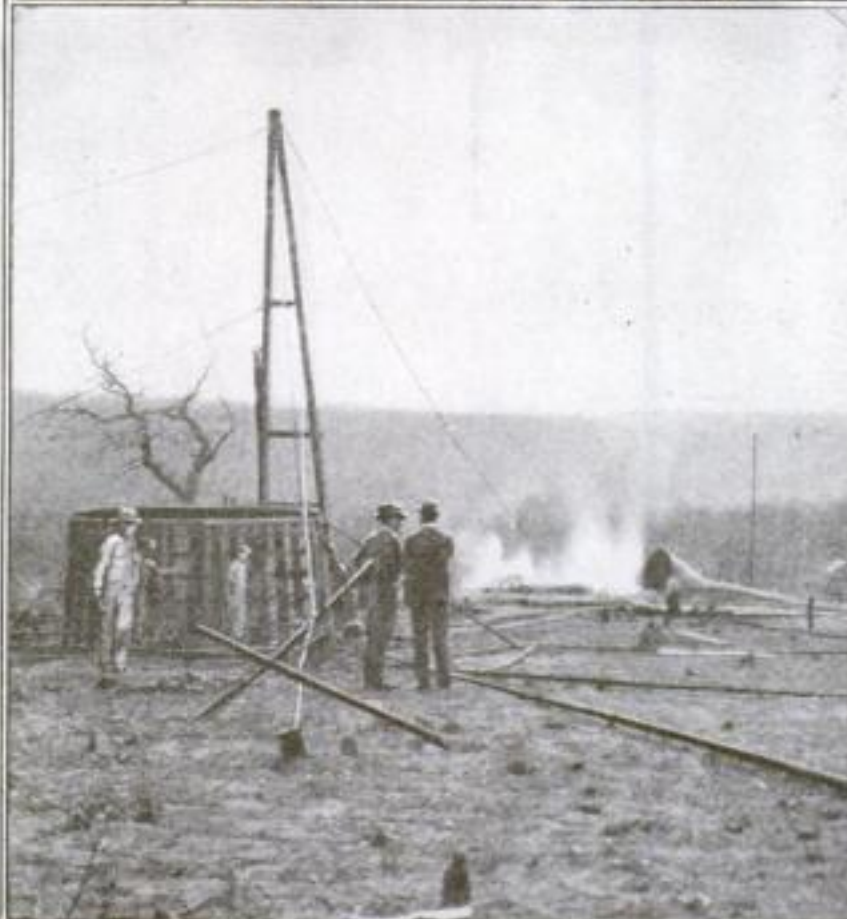
A few years ago the gasoline in natural gas was looked upon as a nuisance. Today it supplies about one tenth of all the gasoline used in this country. Natural-gas gasoline is highly volatile, and is used for mixing with petroleum distillates too heavy to be sold alone as gasoline. The original methods of extracting gasoline from natural gas—by compression and condensation—were applicable only to "wet" gas. Within the last three or four years, however, a new process whereby "dry" gas may also be treated, has been introduced with great success. In this process the gasoline vapor is first absorbed from the gas by means of oil, and then distilled from the latter.

The latest episode in the story of natural gas came to light just after the Great War, when it was announced that methods had been developed for extracting helium from natural gas of low heating value found chiefly in Kansas and

Some burning gas-wells can be controlled by placing a hood over the flame



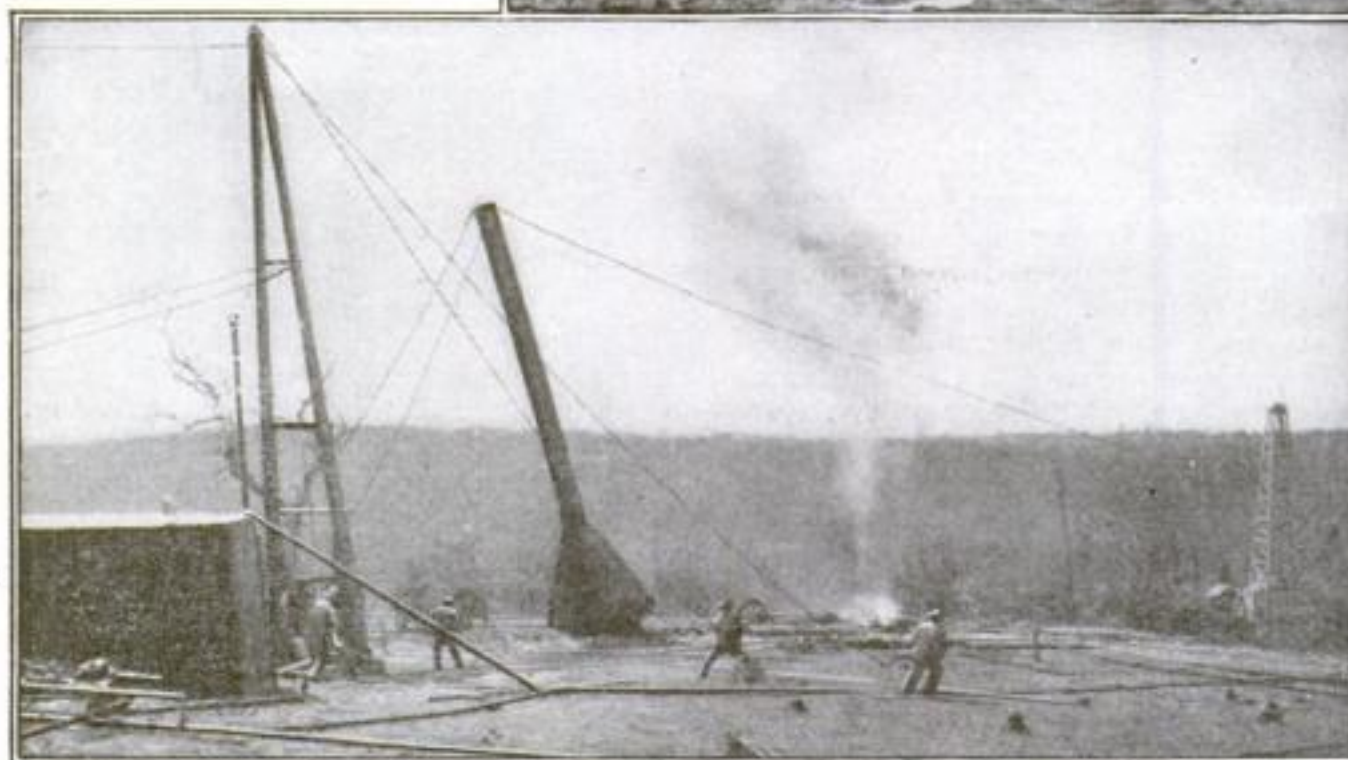
Here in the gasoline still the precious by-products are extracted, improving the quality of the gas



Texas. It was proposed to use the helium, which is non-inflammable and non-explosive, as a substitute for hydrogen in filling balloons and airships. The abrupt ending of hostilities delayed the execution of this plan, but possible commercial uses of helium are under consideration, including its substitution for nitrogen in filling incandescent lamps.

### Value of Helium

Every day brings attention to the increasing value of the natural gas that men formerly permitted to go to waste. If all the value that was then turned out into the air could be corralled and brought back to the service of industry, the coffers of the world would be considerably richer thereby. If all of our army balloons during the war had been inflated with helium, a product of natural gas, there would have been greater safety. A dirigible filled with hydrogen, or one of the immense Zeppelins inflated with the inflammable gas, is a menace unless special precautions are taken to ground it properly and prevent a static discharge from setting it afire. Many a balloon has blown up when coming in contact with a minor object that could conduct the charge of electricity, but with helium there is no danger from this source.

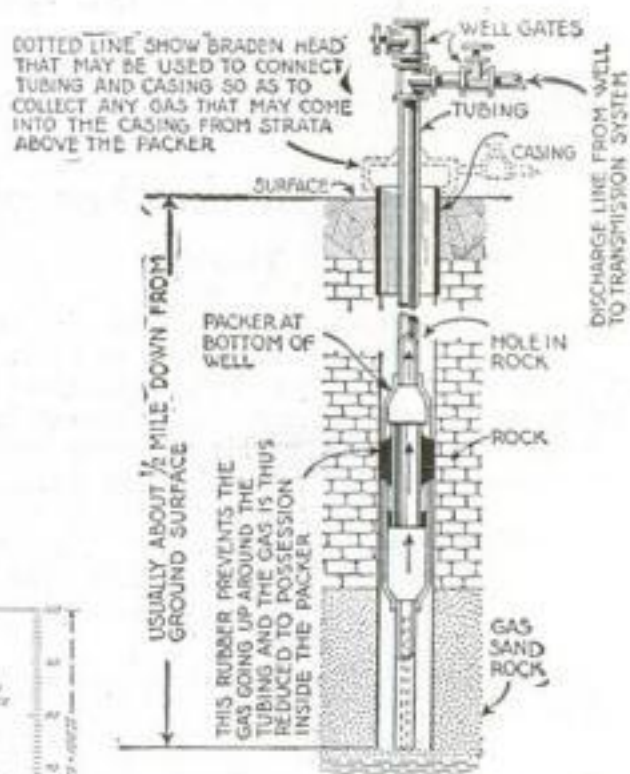


Getting the hood in position. Cables are swung for a trolley, and the great metal hood is pulled directly over the flame; then it is released





The natural gas is piped away to the service lines, distributed to consumers, or sent to stills where by-products are condensed from it. Gasoline and other useful substances are squeezed from gas that in former days was allowed to escape and be lost



Showing the relative amount of natural gas that is used for domestic and for industrial purposes

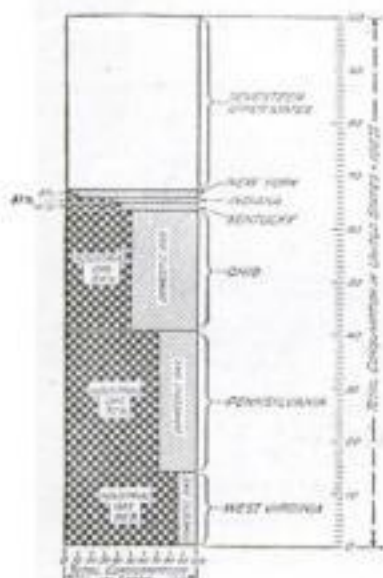


Diagram of a gas-well. A "packer," or plugging device, is fastened in the casing immediately above the gas-bearing stratum, the gas being forced by its own expansion into the tubing to the transmission pipes

Shooting an oil-well opens the way for a great "blow-off" of sand and natural gas. The friction of the sand against the iron pipe often causes sparks, and these sometimes set fire to the gas







By using an adjustable hinge, the ceiling fan may be induced to do double work

### A Folding Fan Increases Air Currents

**"PUT** a hinge on the ceiling fan, partly fold back the blades, and the air will be distributed over a greater area of the room. But this is not all: you can fold the blades entirely up and put a bag over them!"

This is what the man who has a folding ceiling fan has to say about it.

The hinge may be attached to any fan after the blades have been sawed off. Then anybody can make the adjustments by merely loosening three thumb-screws.

Partly folded upward, the blades, when they are revolved, will cut the air in such a manner as to throw the currents outward and downward over a wider area of space than usual.

In winter-time, when the fan is no longer needed, the blades may be folded upward, and a bag, kept in the small tube in the fan stem, may be taken out and adjusted around the blades, thus protecting them during the idle months.

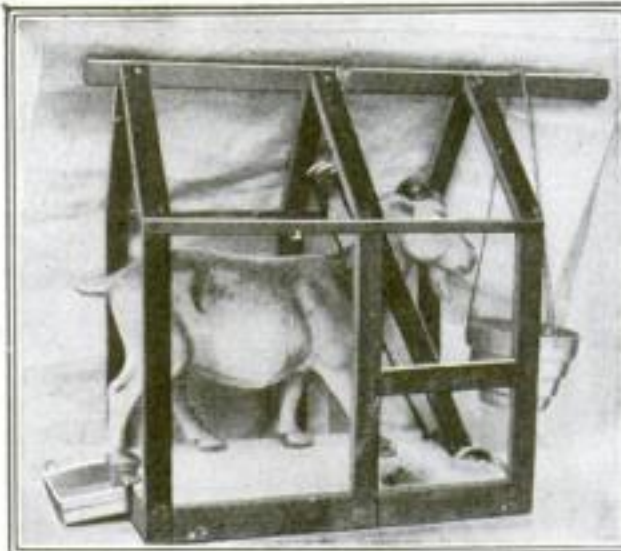
Mr. A. W. Tucker, chief engineer of the Hotel Tulsa, in the city of Tulsa, Okla., is the inventor of this very ingenious device.

## Get Your Own Goat

**WHERE** would I keep her? That's what you say when some anti-food-trust enthusiast suggests that you get a milk goat. Mr. J. Brown, of Evanston, Ill., suggests that you keep her in your back yard. He has invented a goat stall that is easily and cheaply built and takes up little space.

It is made of wooden beams, covered with canvas that rolls up conveniently. The floor is made of concrete and is easily cleaned. A bucket for the goat's food hangs from the top beam. The whole stall is hardly any larger than the goat herself. Thus, in cold and stormy weather it can be moved to the cellar.

A good goat will cost about thirty-five dollars and will eat food that a cow would spurn; yet she will produce better and more nutritious milk than a cow. A goat produces twelve times her weight in milk in one milking period, a cow only four times her weight.



Goats are cheap and the milk good. Why not keep one in your back yard?

## Sailors on the Half-Shell

**WHENEVER** United States battleships set out for maneuvers the sailors rejoice. They like the excitement and the sport of mimic warfare. Below you see some of them playing "oyster" on the deck of one of the battleships. They are all on half-shells.

These half-shells are parts of mines. During the maneuvers mines are laid, guns fired at targets, and submarines attacked. One of the targets is in the picture.



These sailors on the half-shell are ready to take part in a mimic warfare; the shells they are sitting in are parts of mines



This little llama was born knock-kneed; but his keeper is correcting the defect

## Trials of a Knock-Kneed Young Llama

**KNOCK-KNEED** llamas are just as unattractive as knock-kneed men, and in both cases the defect should be remedied when they are young.

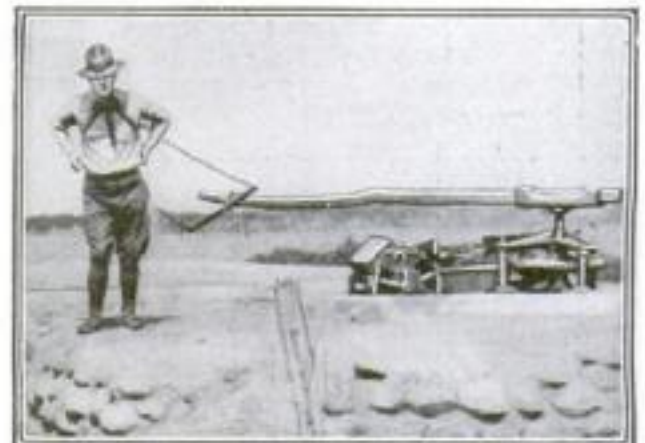
One baby llama that lives in the Cincinnati Zoo was born with these ingrowing knees, and his keeper strapped them up in a pair of iron braces. At first the baby objected; he refused to walk or even stand up when they were on. But his grouch gained him naught, and in a little while he was frisking about with the rest of his family. Every day his keeper drew the straps a little tighter, and in five months his legs were perfectly straight.

When he grows old enough to care about his good looks he will undoubtedly be thankful for this deed of his keeper.

## In the Age of Machinery!

**AROUND** and around in the same old circle goes Mr. W. W. Pigue, of Presidio, Tex. He is harnessed to a bar that turns a capstan. And thus he works an irrigating-pump connected with a reservoir on his ranch.

This primitive method of operating a pump is very laborious and seems unnecessary in this great age of machinery. But perhaps there is no large source of power near Mr. Pigue's ranch—which, by the way, is located very near the Mexican border.



By tramping around and around he operates an irrigating-pump on his Texas ranch





© Underwood &amp; Underwood

Hats and sleeves indicate wealth in Mongolia; small fortunes are spent on them

### By Their Hats Ye Shall Know Them

**W**OMEN'S hats have often aided in man's financial downfall, but the man from Mongolia suffers most. He saves money all his life with but one object in view—to buy his wife a hat that will be more elaborate than that of the wife of his neighbor. Even a poor man will spend at least two hundred dollars on a hat and a pair of sleeves to go with it. Hats and sleeves are indications of wealth in Mongolia.

What strange hats and sleeves they are! The sleeves are twice as long as they need to be and have ugly puffs at the shoulders. And the hats—a milliner would call them toques with horns standing out on each side. Braided hair switches are tacked on.

### Lunch, Twenty Cents

**C**ONGRESS is still working on the problem of the cost of living, but a Washington man is solving it.

In a sanitary paper box he puts up a "Liberty lunch" consisting of two sandwiches, a piece of cake, and an apple or an orange, and sells them at twenty cents a lunch. He packs the lunches in wooden chests and sells them on the street.

At first the chests were placed on the edge of the sidewalk, and the lunch sold from it. But local restaurant men called attention to a city regulation that prohibits the use of the streets for business purposes, and the twenty-cent lunch was seriously threatened. Then the restaurant man discovered that there is another city regulation that allows the sale of articles from moving carts; so he put wheels on the chests and continued business.



Putting a lunch chest on wheels also put it within the law

### The "Movies" Ancestor

**T**HE desire to produce pictures in motion was partly satisfied in ancient Java long before the dream of Edison was realized. But these forefathers of the "movies" were crude affairs compared with the simplest of modern motion-pictures. A feature of the ancient movies was the telling of the story in spoken words.

From a sheet of deer-skin clever artists cut figures to illustrate the story. The curious figures are held so their shadows are cast upon the screen, and moved about animatedly.



Shadow pictures presented to the United States Museum by the King of Siam

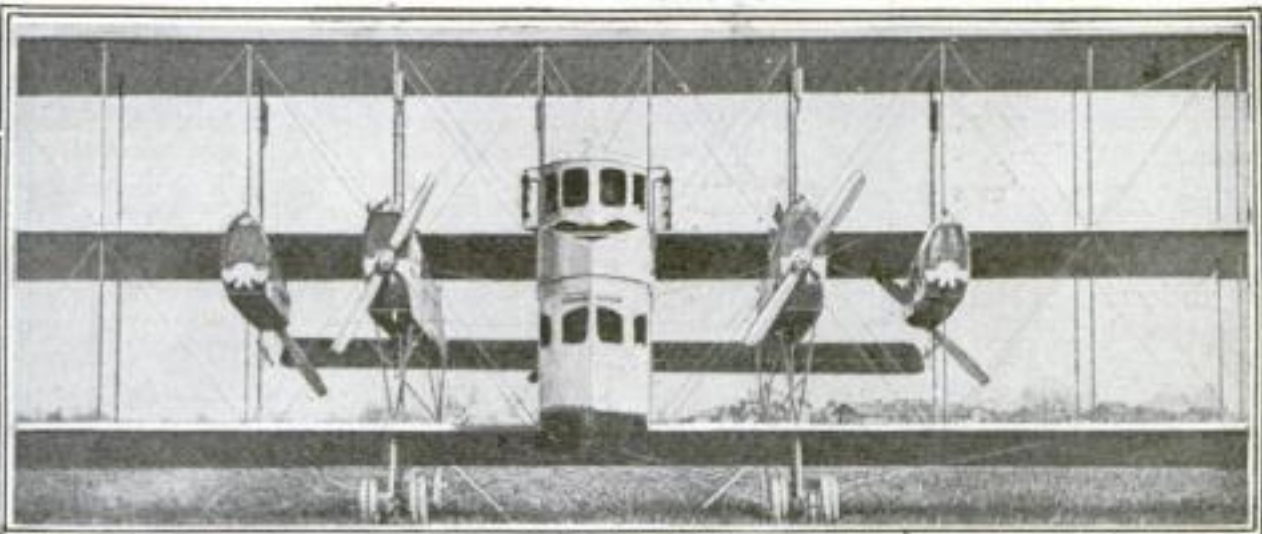
### A Double-Decker Airplane

**D**DOUBLE-DECKER airplanes have recently made their bow with the appearance of a new Italian triplane.

With four propellers to keep the giant flier in the air, the forty people who are seated comfortably in the double-decked fuselage are safely transported from place to place.

Think of an airplane having two decks! Who can forecast the limit of the number of wings and the number of engines and the number of decks that the future generations will witness in travel by means of airplanes? It staggers the most vivid imagination.

The balance between motive power, weight, and area must, of course, be confined within certain limits. When one looks at the fossil remains of some of the ancient gigantic birds and lizards that had the power of flight, it is not unreasonable to speculate on the possible forms of man-built flying-machines.



© Kadat &amp; Herbert

The new Italian triplane carries forty people and is driven by four engines. Its unique feature is a double-decked fuselage



© Press Illustrating Service

Although he has embraced a new faith, the Maori still keeps his totem-pole

### In the Land of the Maoris

**P**RESENT-DAY Maoris are nominally Christians, but there are many old chiefs who are still fond of their ancient totem-poles. Their religion is that of nature-worship combined with the veneration of ancestors. A peculiar and interesting detail of their religion is the belief that the soul dwells in each human being's left eye.

The Maoris were enthusiastic cannibals in by-gone days, their favorite dish being roasted hearts. Eating the hearts of their enemies was supposed to give them strength, especially in the pursuit of war-time activities.

As for the Maoris' marriage laws, they seem to have had none. But they believe very strongly that man should have absolute power over woman. Even today they have very broad views on the subject of matrimony, and each man generally takes unto himself as many wives as he can afford to maintain.



# If Your Child Swallows a Safety-Pin

No longer is an operation necessary for the removal of foreign bodies in lungs, esophagus, and stomach

**T**HAT serious situation arising when foreign objects such as beans, corn, nut kernels, nails, tacks, staples, etc., are inhaled into the lungs formerly required extensive and highly dangerous operations or still more dangerous *blind* efforts at removal. Less than one per cent of such objects are coughed out again, and if the object is allowed to remain, various degrees of lung inflammation result.

Nut kernels, particularly those of the peanut, have been found to cause the most rapid, serious, and sometimes fatal results, when drawn into the lungs by young children. The presence of a peanut in the lungs of a child under one year of age has caused death inside of twenty-four hours.

The older the child, the less severe the reaction. Peanuts or peanut candy should never be given to children before they have teeth to chew them thoroughly.

Metallic objects seem to be less irritating to the lower air passages, but if they are not removed extensive lung changes occur, sometimes simulating tuberculosis with such exactitude that patients with foreign objects in the lung have been treated in sanatoriums for this disease. In fact, it was formerly taught that patients with foreign bodies in the lungs ultimately died from pulmonary tuberculosis. Recent studies have proved this incorrect, for the tubercle bacillus has never been found in these cases, and recovery is

complete when the foreign body is removed.

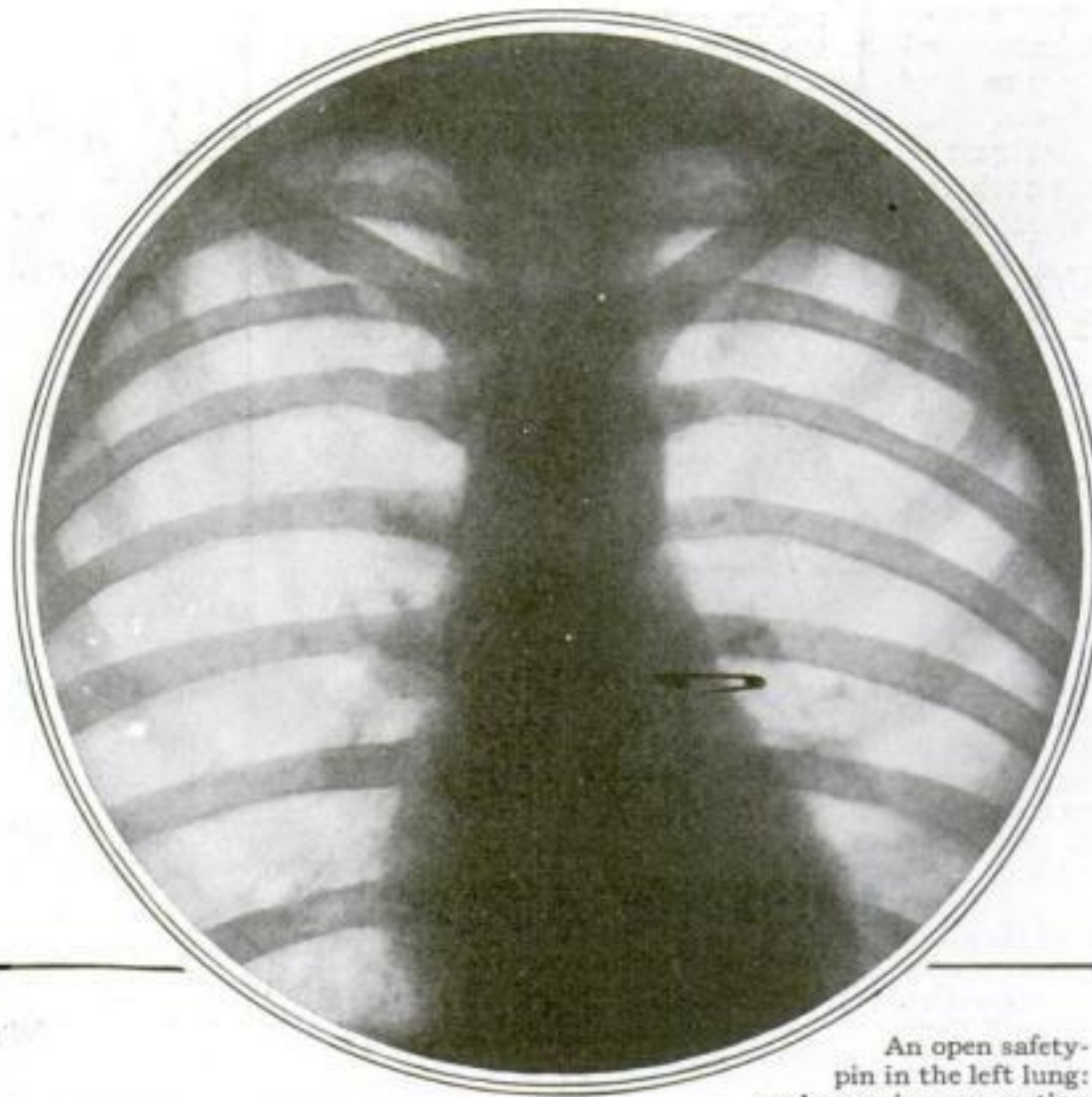
All patients suffering from chest conditions should be studied with the aid of the X-ray, particularly when no tubercle bacilli have been found in the sputum; for in a certain percentage of

these cases a foreign body will be found to be the cause of the trouble. The accident may have happened in early childhood and been forgotten. A collar button is reported to have been removed from the lung after twenty-six years' sojourn, a shawl-pin after twenty-eight years, and an open safety-pin after eighteen years in the lung.

One of the greatest advances in modern surgery is the development of a method by means of which these foreign bodies can be removed from the lungs, the gullet, or the stomach without any cutting whatever. The technic has been elaborated, instruments modified and devised, and the method made practicable by the life-work of an American laryngologist who has removed more foreign bodies than any other person in the world.

In his method a slender hollow brass tube is inserted through the open mouth into the windpipe and down into the lung. The far end of the tube contains an electric light bulb about the size and shape of an oat, which illuminates the interior of the lung, enabling the surgeon to see the obstacle and remove it with long, slender forceps passed through the hollow tube.

This tube is called a bronchoscope. Similar tubes, used to remove objects from the gullet or esophagus, are called esophagoscopes, while still longer electrically lighted tubes, termed gastroscopes, may be passed through the esophagus into the stomach.



An open safety-pin in the left lung: no longer is an operation necessary to remove obstacles

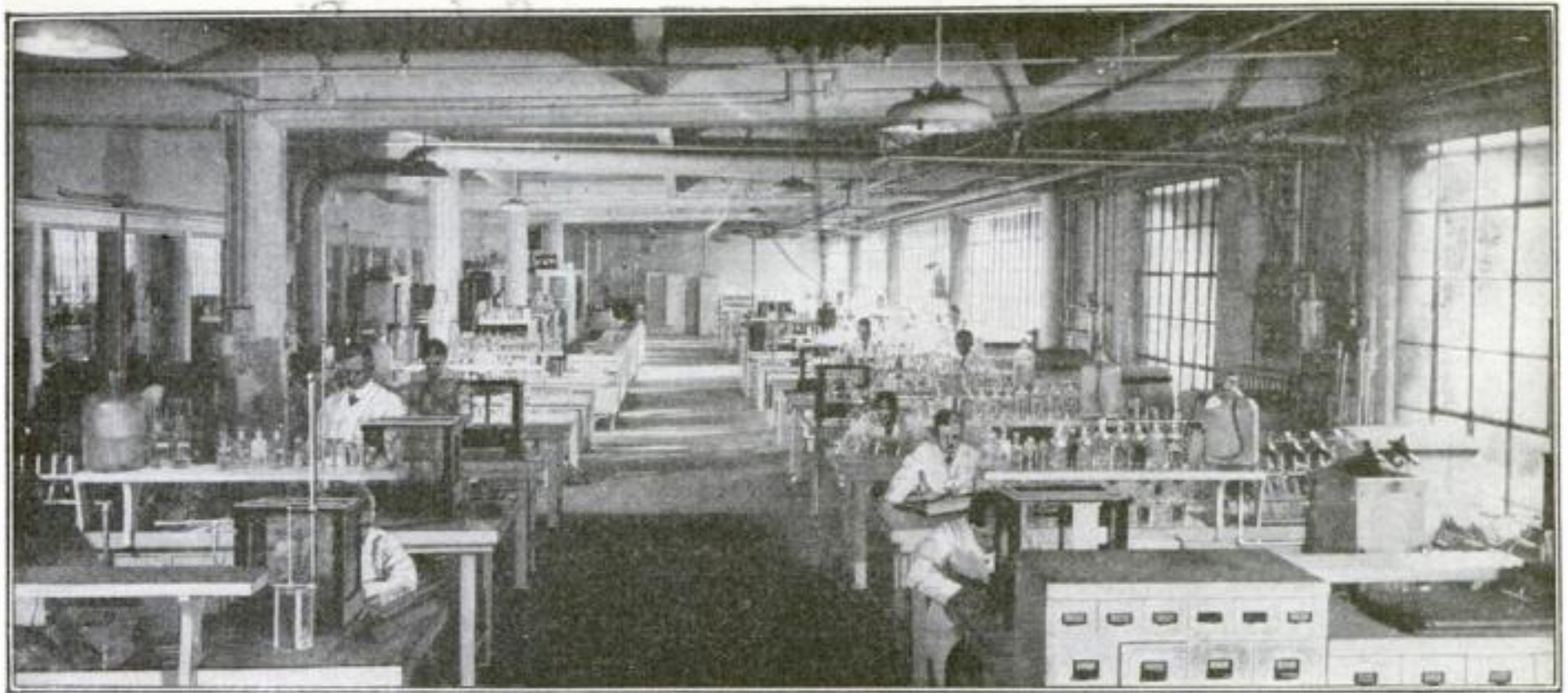


Be careful what you put in your mouth. This remarkable collection was made of the foreign bodies removed from the lungs, esophagus, and stomach of a great surgeon's patients



Instruments used for the bloodless removal of foreign bodies from the lungs, esophagus, and stomach. Great skill and dexterity are necessary for this highly specialized work





At the Ford Chemical Laboratory experts study problems of carburetors, gasoline, oils, and metals

## Working Miracles in Your Own Business

**I** BELIEVE we need in business and in daily life a better chemical view of things. I don't mean that everybody should be a professional chemist, but rather that everybody should maintain enough of a sense of the subject to have, let us say, a chemical conscience; an occasional appreciation of what might be done, as compared with what is done.

Suppose you and the editor of this magazine and I were three friends going to see a fourth friend who lived in the country, five miles from the station, and that we hired a man with a horse and wagon to carry us out to his house.

Suppose we three were very fond of horses—that we knew how to take care of them and hated to see them abused. Then suppose that the driver had the animal checked up out of all reason, and that he kept yanking the bit and teasing the poor creature and abusing it until it didn't know what to do.

If he let his abuse go too far, I have a distinct idea, knowing the editor, and being alive to my own impatience, and guessing the reader to be another of the same sort, that before we had traveled very far we should make that man behave, and cause him, with the overpowering firmness

Theodore N. Vail says: "Research, investigation, experiment are now necessary to hold any position in any industry"

By Ellwood Hendrick



**ELLWOOD**  
**W**E once knew a chair manufacturer who could not understand why his chairs fell apart. He bought the best materials. Finally he consulted a chemist; and the chemist reported: "You think you are buying glue. You are actually buying a sort of starch paste which absorbs water from the air. This is why your chairs fall apart."

Theodore N. Vail, distinguished organizer of the telephone system, says: "Research, investigation, experiment, comprehensive and

**HENDRICK**  
thorough, are now necessary to hold in position any industry and utility enterprise."

Men have spent huge sums in fitting out expeditions to discover buried treasure. If they would only dig up the treasure that lies buried in their own business!

Mr. Ellwood Hendrick who has done much to drive home the importance of research in industry, tells us here what science can do for any manufacturing enterprise to which it is seriously applied.—EDITOR.

power, and coal and iron, and minerals galore; we can grow almost anything that answers the call of the sun; and we want to see our own

American people prosperous as well as good.

We know that, unless the whole world comes to an end, some day we shall be dead and gone, while another generation will live here; and that after it passes away there will be still others in residence; and so on and on and on, as long as there are people.

We do not know those unborn persons, although some of them may be close relatives of ours, and even our own descendants. But just because we don't know them is no reason why we should steal from them.

When a burglar sets out to ply his trade he does not, as a rule, know the man whose house he robs. He would, however, have hard work to find a jury that would acquit him on that ground. The law says he mustn't steal from anybody; and if we had a chemical conscience we should feel that we mustn't do so

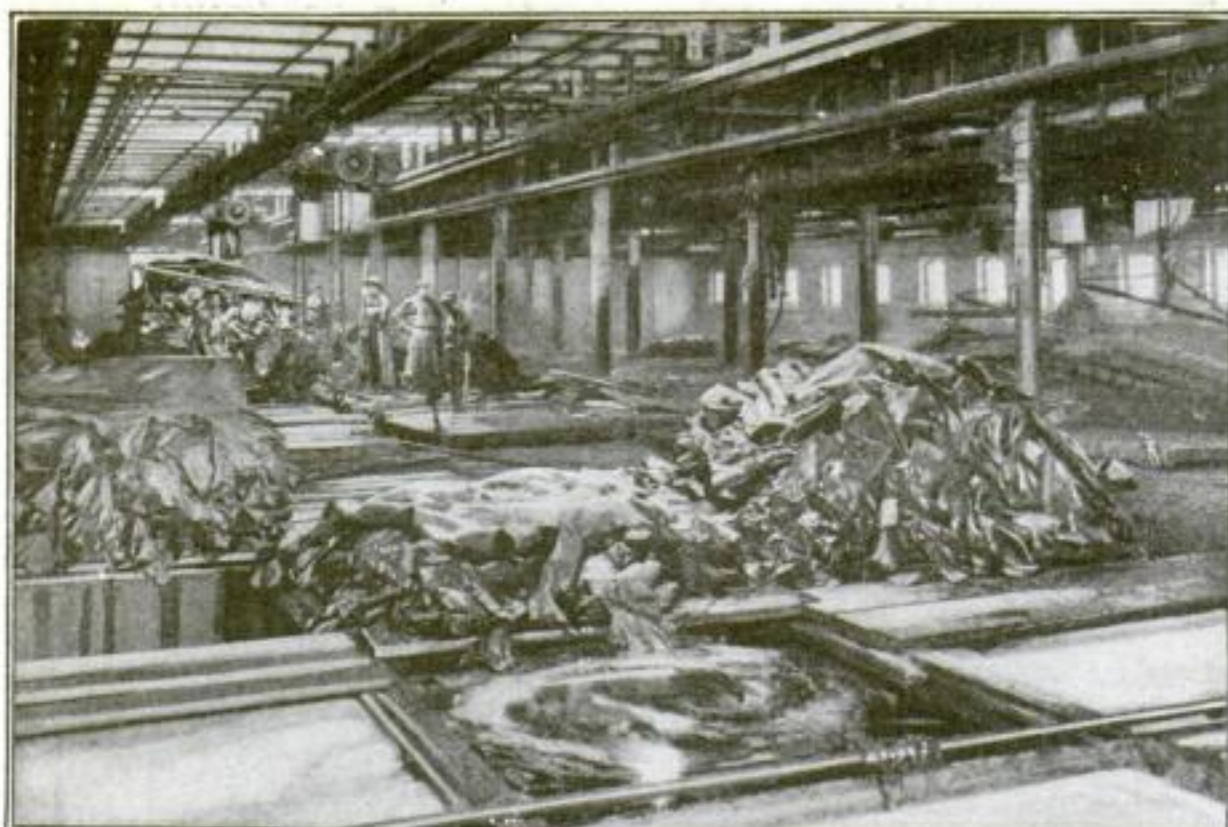
of three husky persons opposed to one, to quit his abuse of the poor beast.

Now, here we live in a country replete with natural wealth. We have good land—splendid land—and water

either, whether the anybodies in question have been born yet, or will not be born for a hundred years.

Whenever we waste coal or oil or natural gas or any of our mineral wealth, we are doing that very thing.





Courtesy of J. H. Ladew Company

Here sole leather is made from hides placed in the tanning vats shown in the foreground. Before being tanned the hides are placed in a weak solution of lime; then they are subjected to a "deliming" process to prevent the danger of brittleness and bad color in the finished product.

So if we had enough chemical sense—not stowed away in some corner of our minds and forgotten, but alive in our consciousness—we should frequently feel, in looking at every-day things, very much as would the three of us in the wagon of that unscrupulous man who abuses his horse.

### The Chemical Eye

Let's look at a big, high-pressure locomotive with the eye of chemistry. It is magnificent in its power, and this we admire, just as we naturally admire bigness and strength in almost anything. But it is propelled by expanding steam, and every puff from its cylinders wastes a lot of power and blows out great quantities of producer gas and particles of coal, all of which would be valuable as fuel. The old engine is an outrageous wastrel, and just because we do not know how to make better machines is no reason why it should not be improved. If we only appreciated the real fact that every bit of coal wasted increases the cost of living, the improved and more economical engines would soon be forthcoming. Necessity is the mother of invention, and when enough people tell somebody who is wasting coal that he should stop wasting it, he is likely to find some way to do so.



© Keystone View Co.

The tanning industry demands the utmost of chemistry. The barks that yield tannin are ground into a coarse powder and subjected to processes of disintegration. The outer layers of the bark contain the bulk of the tannin.

It is the business of science to do the impossible. When we get to the point where we are bound to admit that a thing that should be done can't be done with the means at hand, then is the time to call in the aid of the man of science. Let us review, first, a few industries that have been saved or helped by this means, and then point out a few more where the man of science is needed.

The smelting industries of the Western States were in sore distress. Fumes and dust were spread about the country where they were located, until the farmers appeared with injunctions, which are weapons more effective than pitchforks. To the men of sluggish

mind there was nothing to do but to engage lawyers to contest the injunctions; but that did not change conditions. Finally somebody who knew his business discovered the patent applications of Dr. Frederick G. Cottrell, a junior professor of physical chemistry at the University of California, and observed that he claimed, by means of electric currents of very light voltage, to precipitate particles in suspension in the air. He was induced to engage in research to meet their problems, and soon the smelter dust and fumes were precipitated, the damage ceased, and the worst troubles were over.

### The Paper Need

By grinding wood into a fine powder under water mechanical pulp was made, and the cheapest, poorest kind of paper was manufactured from it. It had neither strength nor lasting qualities, because the cellulose is so mixed with impurities that it oxidizes and turns into dust. Good paper was made from cotton and linen rags, but there weren't rags enough to go around. In the need, a Philadelphia chemist named Tilghman discovered that sulphurous acid dissolves the encrusting substances from the cellulose in wood fiber, thus producing sulphite pulp, from which fine papers are now made.

Iron blast-furnaces were known to turn out more iron in winter than in summer, but the fact was attributed to the inability of men to work as well in hot weather as in cold. Good old ironmasters and sons of ironmasters knew this as the first principle of their trade. But in time they began to think of chemistry in smelting iron, and then men knew that there must be another cause, and that this must reside within the furnace rather than in the men outside it. So James Gayley, an American chemist and engineer, bore in mind the simple fact that the maximum humidity of warm air is greater than that of cold air. In other words, warm air can carry more water suspended in it than cold air can. Let's imagine a cubic mile of air at 95° F., and charged with 100 per cent humidity—that is, carrying as vapor all the water that it can. Then let's cool it down to the freezing-point, to 32° F., allowing



the air to carry all the water in suspension that it is possible to carry at the freezing temperature. How much water do you think would be forced out of that cubic mile of air by the sudden shift in temperature from 95° to 32°? Only a trifling matter of 140,000 tons, or about 35,000,000 gallons!

### *Inventions Come with Need*

Gayley knew this, and he realized how much heat was wasted in driving off the water that was blown into the blast-furnaces in the summer-time. So he proceeded to refrigerate the air before it was used—to cool it with an ice-machine to get the water out of it. This expedient did exactly what Mr. Gayley expected it would do, and saved from one to two dollars a ton on the cost of iron made from that time forth.

These inventions come along about the time when people begin to worry and fret about the cost of things. It is very seldom that they come like a great gift out of a clear sky. They come when they are wanted and needed, and everybody says so; when not only one man but a great many men are anxiously looking for them.

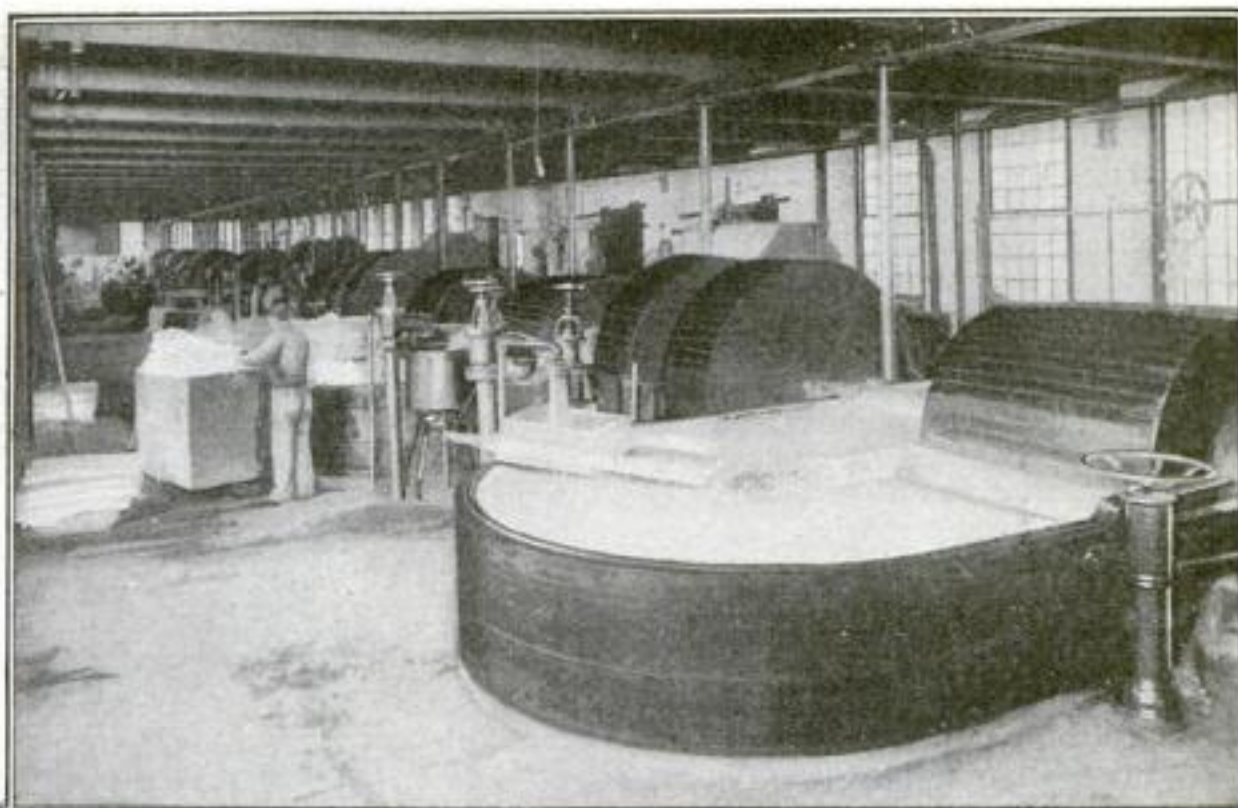
Thomas A. Edison says that 98 per cent of his so-called genius is perspiration and not more than 2 per cent is inspiration.

Now for a few things that should be done, but are not being done: a few places where the man of science is needed.

Speaking of the waste of burning coal in furnaces and under boilers, why do we not burn powdered coal blown in with compressed air, as they do in cement-mills? By this means practically complete combustion is obtained. The trouble is, the heat is too great, and it warps the boiler-plates. It needs to be diffused. In other words, we get, at a greatly reduced rate, too much of a good thing.

### *The Great Necessity*

All that is needed is the diffusion of heat, so as to spread it over a greater surface and to take care of the ash better. Of course, it can't be invented by somebody who thinks he sees a light when he thinks of a fire-brick; but somebody with an understanding of physics and a *flair* for refractories will invent it some day, and then we shall not be bothered with stokers afloat and ashore, and we shall



Courtesy of American Writing Paper Company

In the manufacture of the fine grades of linen paper, from boiling the rags, through the bleaching to the final beating, chemistry works its magic. Here in the great beaters a number of complicated chemical processes take place, few of which are thoroughly understood

for these industries, besides the lumber we get as it is. The recovery of some of the products is just beginning.

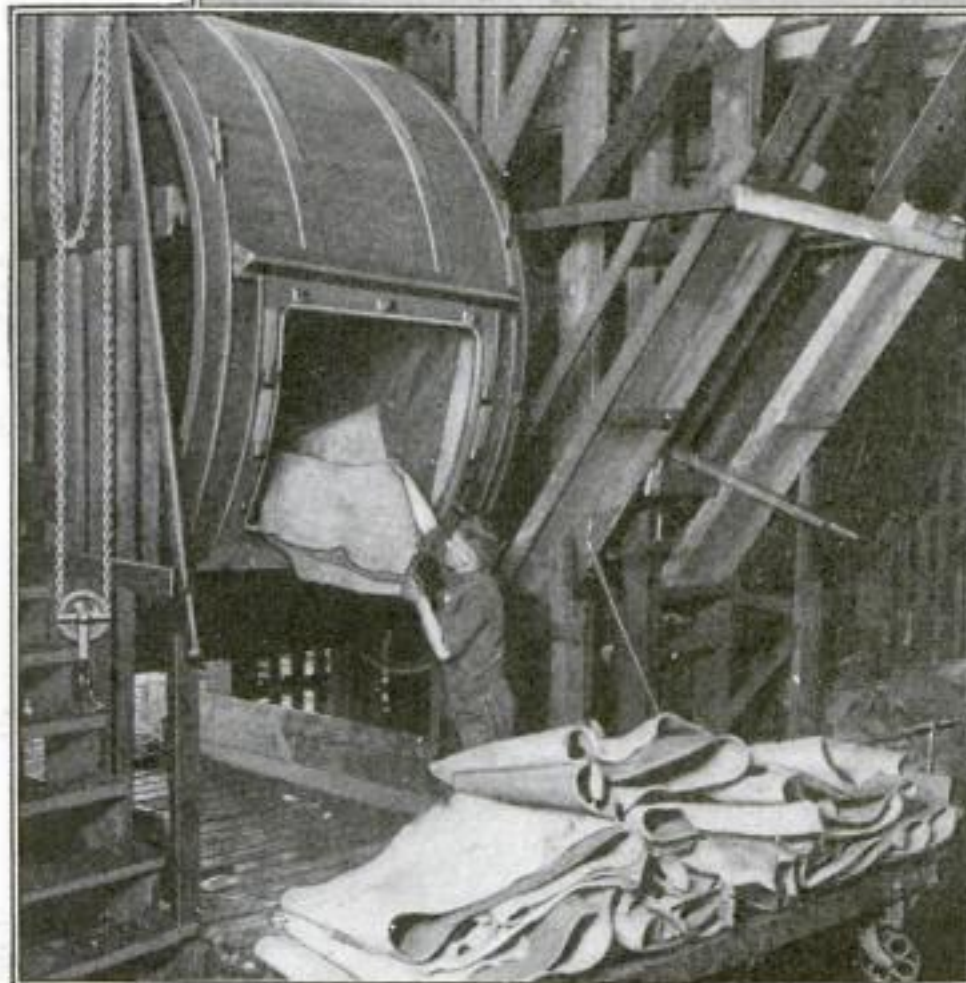
We need a new bleaching agent in place of chlorine. The price of cotton is away up, and it is not growing more plentiful. Production of cotton goods is not increasing, and all of us, rich and poor alike, have to wear shirts and underwear.

### *Studying Cotton*

In some exhaustive laundry tests directed by W. F. Farragher it was found that men's collars

that were washed and also bleached broke after from seven to nine turns through the laundry, while a control series, which had been washed, but not bleached, stood twenty-five similar turns before they gave out. Cotton thread that broke with a weight of 1,750 grams was washed and bleached twenty times by the regular laundry methods; then it broke with a weight of 100 grams. Thus we keep buying cotton cloth at present prices, and destroying it, not by wear, nor yet by washing it clean, but by bleaching it.

There's no use in scolding or grumbling or finding fault with people for not doing what we do not know how to do ourselves. These problems are



Courtesy of J. H. Ladew Company

The tanned hides, now made into sheets of leather, must be oiled to prevent cracking. The "blubber" oil or other substance used in oiling the leather is manipulated in a great drum

save coal, which is so necessary as to constitute a virtue.

It was, as I recall it, about 1911 or 1912 that Dr. Arthur D. Little and his staff made an investigation of the long-leaf pine industry of this country. These figures have been printed many times, but they will bear repeating. One third of the wood cut is saved and the rest is wasted. The stumps remain in the soil indefinitely, and cause it to be of little value.

Out of these stumps and the rubbish that is burned there is (or, rather, there was at the time) a daily waste of 40,000 tons of paper, 3,000 tons of rosin, 300,000 gallons of turpentine, 600,000 gallons of ethyl or grain alcohol, together with the fuel



solved by research rather than by lucky strikes in invention. When it became necessary to detect submarines in order to win the war, to find out where they were so that they might be destroyed with depth bombs, the mails were full of proposals and inventions sent from all over the country to the Naval Advisory Board. Not one in ten thousand of these happy thoughts was worthy of attention. The solution was reached by ten selected men, all of them physicists of the first rank, working in collaboration with selected colleagues from Allied countries.

There isn't any such thing as democracy in science in the sense that one man is entitled to the same consideration as another. The more a man knows, the keener his understanding and the livelier and more active his imagination is in regard to the workings of atoms and molecules and ions and the forces of nature, the more superior is he to the rest of us, in the scientific sense.

It is very much as if we were on a ship at sea, when the problem to be solved is to steer the right course to reach our destination. Experience teaches us that it is better to leave that problem to the captain, who is familiar with navigation, than for a thousand passengers who are not familiar with navigation to offer their advice, their opinions, and their notions of what is the best thing to do.

### Some Tanning Discoveries

Tanners have needed chemical help for a long time. We used to think that the longer the time spent in tanning the better the leather was bound to be; but it is not so. What is needed is good head-work rather than mere waiting. When the pelts of animals are allowed to remain moist they rot, whereas if they are dried they become hard and heavy. The art of tanning consists in converting that animal matter in the hides which will rot into permanent material at the same time soft and flexible, according to the use to which the leather is to be put. The work must be done thoroughly, but it is just as easy to soak a hide too long as not enough.

Chrome tanning of leather was undertaken abroad by cumbersome and ineffective methods. A much better process had been worked out and patented in America, but it was overlooked and forgotten by the tanners until they engaged a real chemist to look into the subject generally. He developed the American process for them, and soon 95 per cent of all the upper leather produced in the country

was chrome-tanned in the new way.

Leather is scarce and high. But it was neither a fisherman nor a tanner who added shark-skins, which are rapidly coming into the present supply. It was Dr. Allen Rogers, of Brooklyn, who teaches industrial chemistry at the Pratt Institute and conducts a course on the technology of tanning.

A great number of machines could be made much lighter than they are by the use of proper alloys of steel to meet the requirements of each member of the apparatus.

### Farmers' Problems

How does it come that farmers buy "complete" and mixed fertilizers, composed of small amounts of needed chemical bodies mixed with large amounts of filler, and pay heavy freight charges on what might cost them but a fraction of their present expense?

The only trouble is that we don't know enough yet—don't know what our soils require and what our crops demand; and so we put on, in effect, a patent medicine, which is likely to contain what is needed as well as what is

not. But think of the expense! I repeat, however, there is no use in scolding unless we are ready and competent to go to the farmer and tell him just what to do and how to do it.

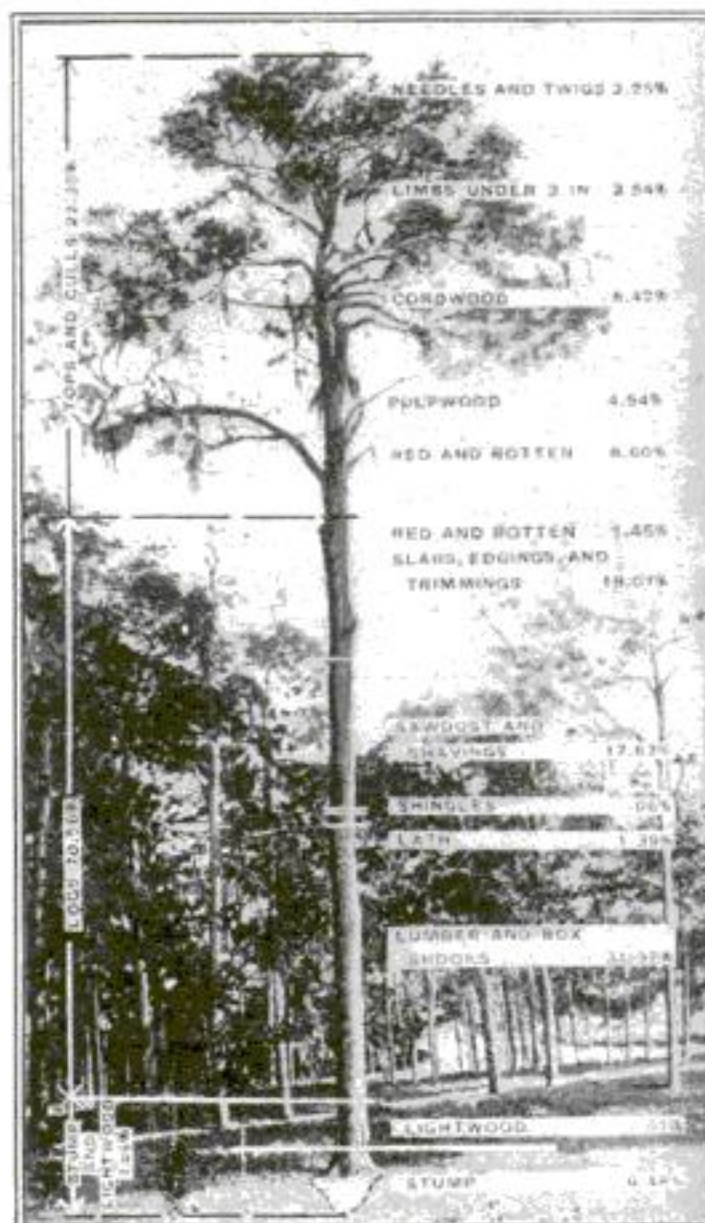
We could go right on down the list through nearly every industry and point out where science can help. The main thing is to know this and to feel it. Then we can ask for help, and very often we can get it. It is not chemistry alone that is needed, however. There's botany, for instance, that we used to think a pleasant study for young ladies and children, on the ground that it would not corrupt their tender minds. But some remarkable hybrid trees have been developed that produce wood as firm and as good as the original wild trees, but which grow to maturity with surprising rapidity. It is time to begin to think of those trees in problems of reforestation, and to encourage the botanists and foresters and arborists to go on with the good work.

There's another thing to be borne in mind in bringing about these improvements. They have to be paid for, and they cost a lot of money: first, for the research in laboratories; then for industrial development, because factory work is different from laboratory work; and finally for introduction. A patent lasts seventeen years, but it usually takes from eight to ten years for a successful invention to develop, if it involves any change in the habits of persons.

### We Fight Anything New

It is really surprising how we fight against anything that is new. We do this because we don't want to be misled, and there are unfortunately always some persons who are seeking to mislead us; and this makes us wary. But why do we have to be wary? Because we do not know enough to tell whether a proposal really has merit or not. If we knew more we should not need to be so cautious.

Then, too, very often we think we know when we do not. It requires rich men who can afford the risk to foster inventions, but our income tax laws discourage them from doing so, because if the invention fails they lose their money, whereas if it succeeds well enough to make the chance worth taking, the proceeds are taxed away. I am not complaining against the income tax with its surtax on large earnings; I am merely stating the fact that it hinders the development of inventions, of which some are sorely needed for the general welfare.



When this fine long-leaf pine-tree is cut down, two thirds of it is destroyed as waste. According to an investigation made about ten years ago, if the entire tree were used, as it should be, the long-leaf pine industry would yield every day in America 40,000 tons of paper, 3,000 tons of rosin, 300,000 gallons of turpentine, and 600,000 gallons of ethyl or grain alcohol, together with the fuel for these industries, in addition to the lumber that we now obtain



## This School Expands to Fit the Pupils

THE "unit plan" of school housing is coming to stay, in the opinion of officials of the United States Bureau of Education. It substitutes for the usual large factory-like building a series of cottage school-rooms clustered about a central campus. Born in the West, it has been employed most extensively in Colorado and California. Open-air schools have practically doubled in number each year since they were first introduced in Providence, R. I., in 1908. There are now more than six hundred such schools in the United States.

In the unit plan a single room or several, as required, may be built on to meet the growing needs of the particular locality, the increased school space keeping pace with the increase in school enrollment.

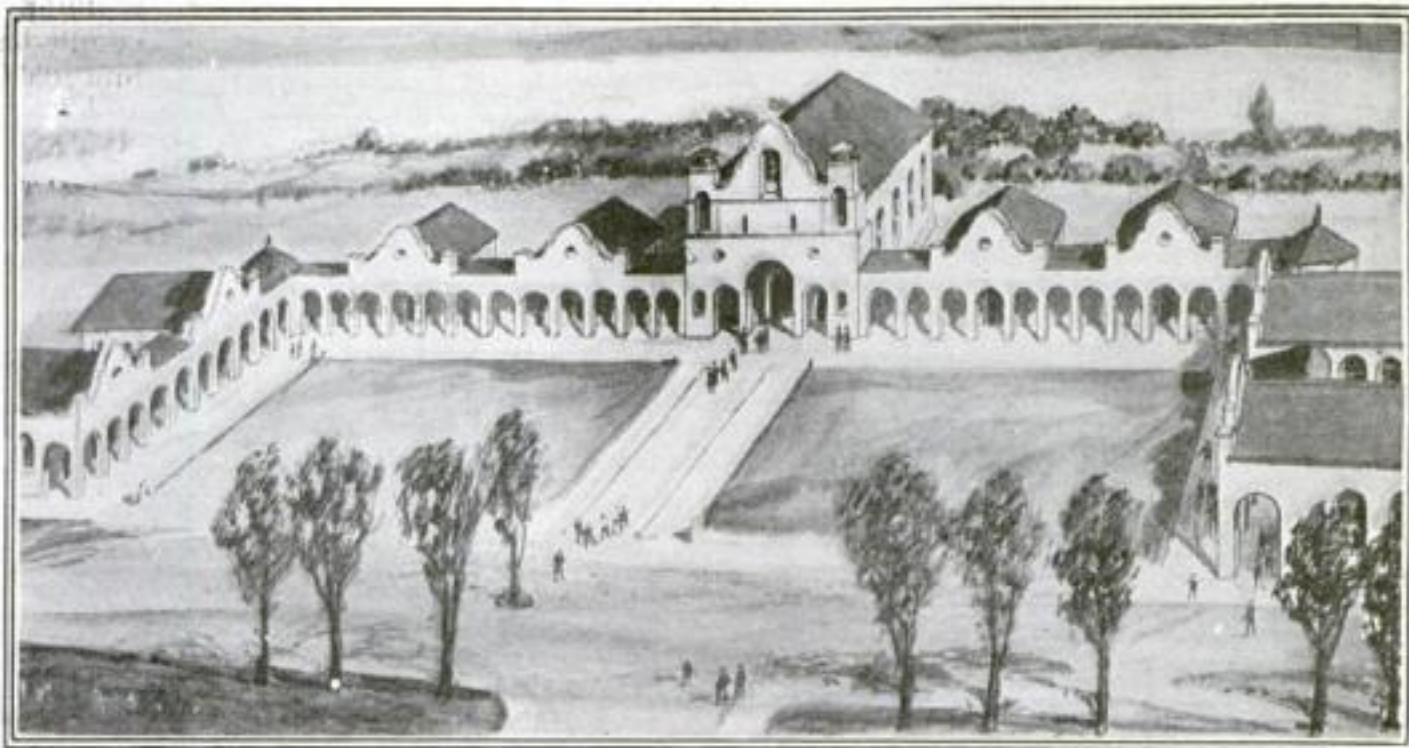
Since each class is housed by itself in one small one-story structure, there is less chance of fire. If by any chance

fire should break out, there is less likelihood of loss of life and damage to the entire property.

One of the best plans for this unit grouping suggested by New York and Denver architects provides for a central building somewhat larger than the class units, to serve as an assembly

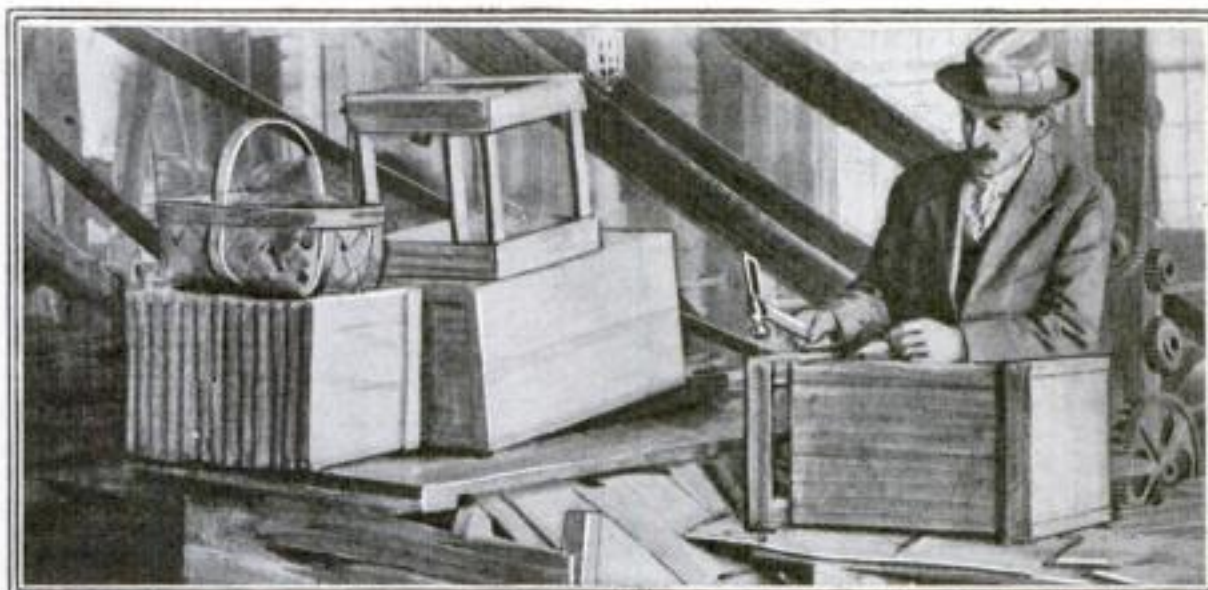
hall, and containing the principal's office and a room for the teachers. On each side of this administration building are grouped the individual classrooms.

One of the advantages claimed is that unit-plan buildings are more easily heated than a single large one.



"Unit-plan" schools such as this can grow as the number of pupils increases, and they are said to be safer and more healthful than the ordinary kind

## Making Crates of the Once Useless Cottonwood



Cottonwood strips are made into egg-crates, butter-boxes, and baskets; the wood is white and odorless

A COTTONWOOD board or strip will curl up like a cart-wheel soon after it is cut. If you try to straighten it out by nailing it down, you will find that the wood is strong enough to twist back to its warped shape and take all the nails with it. Is it any wonder, then, that cottonwood lumber has not been used in the past?

But Mr. Roy Nelson, of Manhattan, Kan., has experimented with Kansas cottonwood, and now he finds that, if it is properly cut and dried, it will follow the straight and narrow path, and may be used for making baskets,

boxes, and egg-crates. The cutting-machine he uses is shown in the lower picture. First, logs are sawed into blocks of the length of the box to be made. One of the blocks is hoisted over the cutting-machine and then lowered into a set of clamps. These clamps are made to revolve, and the block turns with them. As it goes round, a long, sharp knife peels off slices of the required width and thickness. The knife can be adjusted to cut slices from one eightieth to three eighths of an inch in thickness.

A sixteen-inch log can be peeled to the core in three minutes. Then the core is sawed into boards and used for making box-ends. The wood is dried and made up into butter-boxes, egg-crates, chicken-coops, and baskets.

Kansas cottonwood is hard, tough, light, white, odorless, and is better suited for box-making than either Southern or Western cottonwood. According to Mr. Nelson, there is no danger of exhausting the supply of wood, for it grows faster than he uses it. On the river flats several twelve-inch trees have grown since the flood of 1903.



In this cutting-machine the cottonwood log is revolved and a knife slices off strips





Down in one of the galleries of a salt-mine, the workers watched a moving picture of "safety first" lessons.

### Safety First Moving Pictures in a Mine

A LARGE liability company wanted to prevent accidents in a salt-mine for which it was liable. One day representatives arrived at the mine with a moving-picture machine and a reel of "safety first" object lessons.

Instead of calling the miners up, the representatives went down into the mine with their picture-machine and set it up in one of the great rock-salt galleries. A sheet was stretched across a wooden frame, and current from the power-house furnished the necessary light. The workers were called from all corners of the mine and, seated on the salty floor, were given their movie lesson.

### Digging 50,000 Trees a Day

THE nursery tree digger has been devised by Edgar A. Jackson, of Cupertino, Cal. It consists of an automobile engine supported on a frame mounted on runners, which may be anchored in alignment with a row of trees, shrubs, or bushes, and used to operate a cutter for rapidly removing the trees or shrubs.

With this machine 50,000 trees may easily be dug in a day, using about ten gallons of fuel. The gas-engine is geared to drums attached to cables, which in turn are attached to the cutter device. The gear reduction gives a tremendous pull, and holds the cutting knife with a very large lifter, making the hand pulling of the trees easy. The machine moves from one row to another by its own power.

Some of the important features of the machine are that the trees can be dug as deep as desired, in dry or wet ground; the trees are not injured; and a space of twenty feet is ample for operating the machine.



A machine for digging up trees. It may be set up in alignment with a row of trees and remove any that may be desired.

This monster crab was found off the coast of Japan; it measures twelve feet across its outstretched legs.



### An Ugly Giant Crab of Japan

OFF the coast of Japan the spider-crab is of such gigantic size that it is considered one of the wonders of natural history. It is the hugest of all the crustaceans, and looks more as if it belonged to the days of the dinosaurs than to our times.

The crab shown herewith is in the American Museum of Natural History in New York. It measures twelve feet across its outstretched legs.

Japanese divers are in mortal fear of this monstrous crab, believing that some day it will "get"

them while on the bottom. But there is really very little ground for this fear; for, despite its formidable size, this giant is a slow, stupid creature, stalking awkwardly through the gloom on the sea-bottom at depths usually very much greater than those to which divers descend.

The British Museum contains a very large spider-crab with a span of eighteen feet.



© Keystone View Co.

The Korean farmer, dressed in white, walks behind this crude plow drawn by an ox.

### In Leisurely Korea

WITH an iron-shod wooden plow, a large shovel worked by four or five men, one guiding the handle, the others jerking the blade by ropes attached to it, with a bamboo rake, a sharp-pointed hoe, and a few other crude implements, the farmer of Korea sets his eye upon the weather and cultivates his land.

In Korea the sun shines and the rain falls as it does upon the rest of the earth. Light, sandy loam, disintegrated lava, and rich alluvium reach to a depth of from three feet to ten feet.

The farmer in his white dress walks behind the crude plow as it is dragged along over the loose soil by a patient ox. Even with these primitive means, the Korean farmer is able to bring forth two crops a year.

Rice, millet, beans, cotton, hemp, oil-seeds, wheat, oats, barley, and sweet and Irish potatoes are the chief products brought from the soil by the labor of the men and oxen.



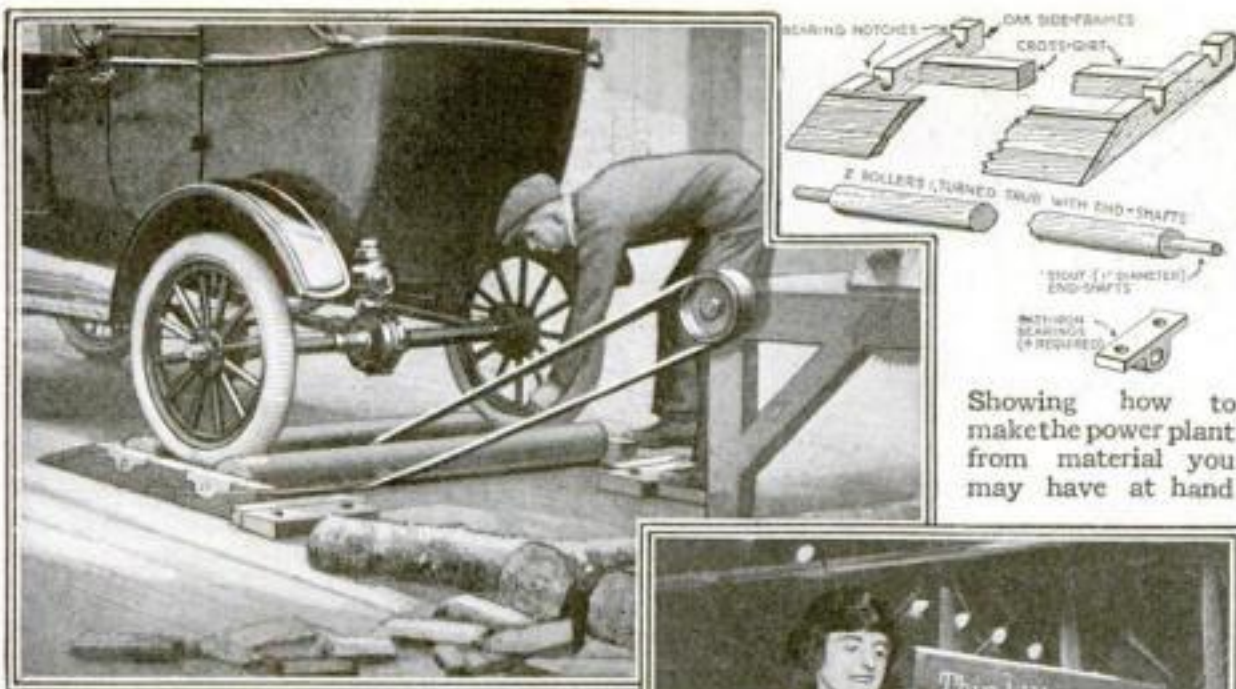
They're hauling in a German mine that was floating around in the Atlantic.

### Working with Death

STANDING on a few hundred pounds of TNT isn't the safest job in the world. It was a necessary one, however, when the United States navy was clearing the mines from the North Sea. Our men were after the American mines laid to keep in the German submarines, but once in a while they found some German mines which had floated loose from their base. These mines will be taken apart by experts.

The United States navy took up more than fifty-five thousand mines in less than six months—probably the most difficult work done in connection with the war by any naval force.





Power-transmission attachments for automobiles may be purchased, but here is one you can make yourself

## Automobile-Power

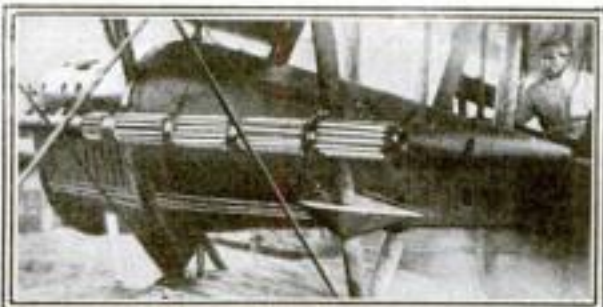
HAVING an automobile furnish power for work is now an old idea: it has been used to advantage for driving saws, pumps, churns, mixers—almost any form of heavy work. Power-transmission attachments for automobiles have been put on the market. They are all right, but costly. Here is a homemade machine-driving attachment which, for utility in an emergency at least, will deliver the power from an automobile "like a steam-engine." No removal of tires or other preparation is necessary—just back your car on to it and it is ready.

The diagram shown above is not dimensioned, since a considerable variation in size or in details of construction may be made to suit the builder's own ideas or to fit the parts he may have on hand or may have to buy, such as the two rollers with end-shafts or gudgeons and some sort of bearings for them.

## Quieting the Airplane

"CUT-OUTS prohibited!" The motorist sees this sign everywhere. The airplane, on the other hand, has sailed serenely by, making all the noise it wanted to. It has not worn a silencer chiefly because a silencer would reduce the power of the engine. But today's engine can afford this loss.

As a result, the French army has adopted for its airplanes the new silencer shown below. It is attached to the exhaust-pipe, and muffles not only the sound but also the flames due to the explosion of gasoline when the pipe is overheated. The silencer follows the principle of the well known Maxim silencer.



© Keystone View Co.

The silencer on the airplane's exhaust not only reduces noise but prevents fire



© Kadel & Herbert

A pig that came to market from Omaha, Neb., to Chicago, following the route of the air highway

## The Pig that Came in the Air Mail

A FLYING pig! Consigned from Omaha, Neb., to Chicago, Ill., the animal was posted by a company that deals in cattle, and was received by Reed Landis, a former army aviator who is now a moving-picture actor.

What must one expect in the future? Will cows and horses also be treated to trips in the air?

It is not long since the idea of regularly transporting letters by airplane was looked at skeptically. It seemed incredible that the tricky, uncertain highway of the clouds could ever be risked in regular transportation of important mail. But the time has come when wind, rain, and rarely fog, are enough to delay the mail trips that are now daily conducted across the sky.



One scarecrow watches the sky and the other the ground to see that no hungry bird approaches

## Scarecrow Guardians of the Cherry-Tree

MR. and Mrs. Scarecrow have been appointed guardians of the cherry-tree. Their job is not to watch out for bad George Washingtons with hatchets in their hands, but to see that no birds come along and steal the ripening cherries.

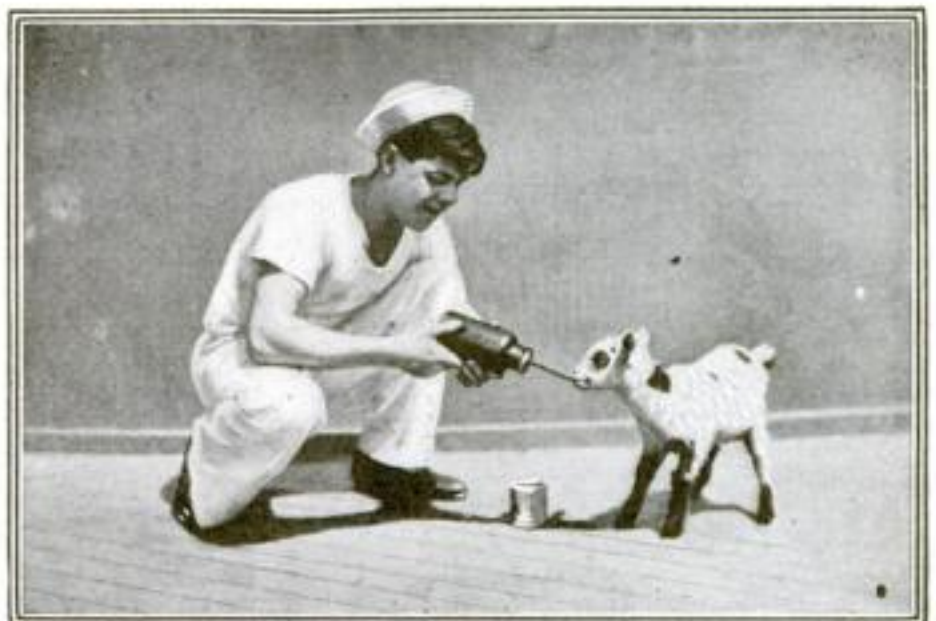
Mr. Scarecrow has climbed a ladder and is scanning the sky for the approaching enemy. Mrs. Scarecrow stands below and keeps a sharp eye on all moving things. Between them, they have managed to scare off all marauders and the cherries will soon be ripe.

## Billy's Nurse

"HE'S painting the white goat black!" That is what you naturally think at your first glimpse of the picture below. But we find that the goat was born with those black splotches and the bottle in question contains, not shoe-blackening, but milk.

The seeming villain is really very tender-hearted. He is a self-appointed nurse, and he watches over baby Billy as carefully as if he were his mother.

Billy is the ship's new mascot. He is too young to eat solid food and he takes to the bottle quite naturally.



Not shoe-blackening but milk is contained in that bottle; the sailor is baby Billy's nurse





Carried in his pocket the mechanic makes use of canned heat to supply the fuel for his soldering-iron

### Canned Heat for the Soldering-Iron

**T**OURISTS have found that canned heat is just what they need for cooking their meals by the wayside.

But this is not all. The little ten-cent can of condensed heat also helps the mechanic who has a piece of soldering to do. The iron can be quickly heated and the broken pipe or piece of metal soon mended.



© Kadol & Herbert

A fifth leg growing out of a good-luck hump on her back saved Bossy's life

### Bossy's Fifth Leg

**B**ACK on the farm Bossy's brothers and sisters had always laughed at her fifth leg. It grew out of her neck and hung limply over her left shoulder. As Bossy went from calfhood into cowhood a hump developed at the spot where the fifth leg grew. Truly she was the ugly duckling of her family.

But when she arrived at the slaughter-house, her much-abused hump and leg saved her life. The hump was looked on as a token of good luck; and her fifth leg put her in the class with freaks. The butchers decided that they would make more money by selling her than by killing her.

Bids from zoos, circuses, and museums will be carefully considered by her present owners.



When a cup is filled the wheel turns slowly and the bait-cup drops into the basin of insecticide

### A Trap to Catch Ants

**T**HERE are elephant-traps, and there are mouse-traps; now there is invented a trap to catch ants! It consists of a magazine having a zigzag channel holding cylindrical cups in which bait is deposited. A spring-motor or a small water-wheel operates the trap, permitting the bait to be exposed for a sufficient time to attract the insects, then allowing the end cup in the row to be dumped into a basin filled with an insect destroyer.

Each bait is formed from a roll of cotton gauze saturated with a sticky material intended to appeal to the particular taste of the ants. Beetles, flies, and other pests may also be allured into the trap, automatically to meet destruction in the solution in the basin.

At the end of the channel the bait rolls into the arms attached to the wheel, and this slowly drops the can into the liquid, automatically throwing back the wheel and making ready for the next bait-cylinder.



He carried this apple-tree from the East to the West sixty years ago, and it still bears fruit



He carries his tools in a cloth case that weighs very little

### He Carries His Tools with Him

**A**N order comes to the job foreman summoning him to work upon the wooden forms of a new skyscraper. The framework forms are necessary before the concrete can be poured, so the carpenter takes his tools and starts for the job.

Will he have to carry them in a heavy tool-box? Not if he is wise, and if he has become acquainted with a recently invented serviceable tool-kit. This kit is so light and compact that it can be strapped over one shoulder. The tools are protected and well managed as a unit. The carpenter can have access to them at a moment's notice, and when going up a ladder finds the kit more conveniently managed than a box.

When the day's work is done the tool-case is easily hung by its strap to the wall of the tool-room.

### An Apple-Tree of Sixty

**I**N 1858 a Missouri farmer decided that he wanted to take Greeley's advice and go West to do a little growing up with the country. He took with him a tiny apple-tree growing on his farm, to see what luck it might bring him.

From all appearances he made a wise move, for the tree is still growing and showering apples all over the orchard each year.

In 1897 the tree was badly scorched when the farmer's house burned down, but no serious damage was done.

The tree bears heavily every other year, and even in "off" years it has a fairly good crop. In 1914 there were sixty-five boxes of the finest apples picked and packed from this one tree.

This remarkable patriarch is a Rhode Island greening.





He carries his money in a water-tight safe on his belt

## Take Your Money with You When You Swim

**Y**OU come out of the water after a swim and you're hungry for a frankfurter and roll. But you haven't any money with you—no place in your bathing-suit to keep it; so you pass up the frankfurter.

Now there is a new belt for bathing-suits that has a small metal safe fastened to the buckle. It is absolutely water-tight and will shelter dollar bills from the briny deep.

After you have put your money inside the safe you screw on a metal cap and think no more about it until you are hungry.

## Weighing Crops in the Field

**A** SIMPLE but effective method of weighing small quantities of hay or other farm crops in the field has been devised by a Klamath County (Oregon) farmer.

Desiring to weigh a certain quantity of alfalfa with which he had been experimenting, but finding the stack too heavy and cumbersome to be lifted, he overcame the difficulty by taking two stout poles, about eight feet long, and crossing them securely near the top.

Through the notch thus formed he passed a third pole, to the end of which a small scale had been fastened. The scale in turn was hooked into a rope passed around the stack of alfalfa, and the load was easily lifted from the ground by working the cross-pole as a lever.

The soldier in the picture is glad to be back on the farm he used to find so dull.



Every Cree Indian is his Indian companion's barber; he never charges anything for the hair-cut or shave

## An Indian Barber-Shop

**U**SING the reflection from a pool for a mirror, with the open sky for a ceiling, and a grassy plot or a dirt-bank for a barber's chair, the Cree Indian has his hair cut.

For two hundred and thirty-nine years the Hudson's Bay Company has employed as trappers and hunters the Indians and Eskimos living on the shores and inlets of Hudson's Bay and as far west as the Pacific. From the millions of acres in the unknown north come the valuable pelts of fur-bearing animals.

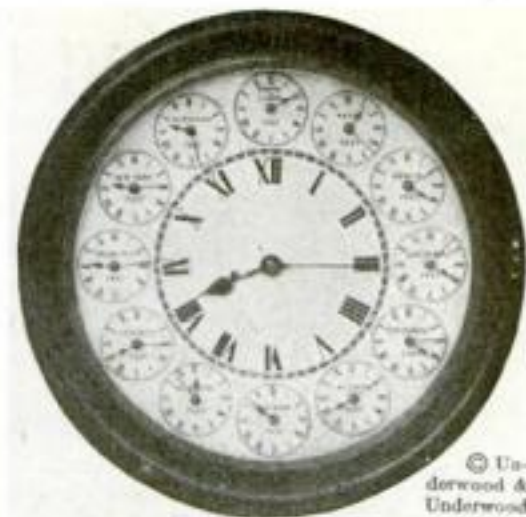
Every Indian is a barber to his Indian companion. There is no charge for the service—the result often being of such a nature that the victim should be paid for the operation.

During the months of June, July, and August the Cree is fishing and preparing his traps and snares for winter, drawing wood, and visiting the trading-posts.

Though living outdoors, few are long-lived. Tuberculosis is common among all the Indians of the Northwest, and is due, no doubt, to their careless manner of living.



A spring-scale is attached to a pole and the outfit is easily carried from place to place



This clock has thirteen pairs of hands, and it tells time all over the world

## Telling Time All Over the World

**W**HEN it's quarter past eight in New Orleans, it's seven minutes past four in Constantinople, ten past two in London, and quarter past nine in New York. You may get similar information about nine other cities if you look at the clock in the picture above. This clock's home town is New Orleans. It was built in the days of the Civil War.

The thirteen pairs of hands on the old clock's face go round together and are operated by one set of works that is wound up regularly every seven days.

Hand - rest, light, and paper on which to write in the dark



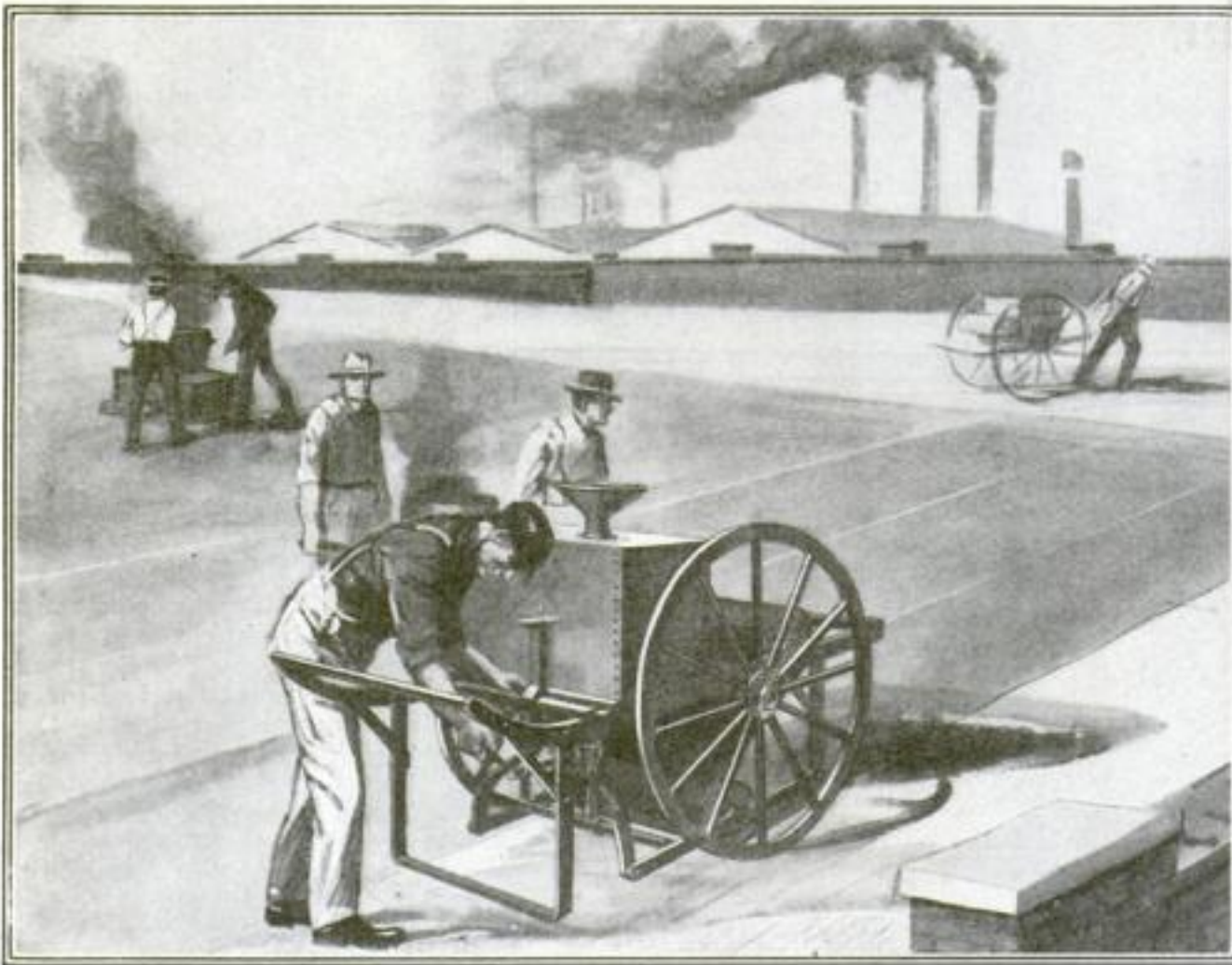
## Notes by Pocket-Light

**T**HE corner policeman who wishes to make a memorandum in his note-book, and who does not wish at that instant to step out into the light to do so, has at his service a convenient combination of note-book and pocket-light. Nurses, doctors, and detectives can make use of it when writing in a dim light. Artists who want to make sketches in pencil in the dark, astronomical observers who wish to jot down the path of a stray meteor and do not wish to trust their memory until they can get indoors, also army and navy officers making notes at night when it is necessary to do so in the dark, will find in the pocket-light note-book a worthy friend.

This novelty is about the size of an ordinary pocket-light. It has an extra hinged surface upon which rests the writing-pad, and is so constructed that the regular lid of the light-compartment serves as a rest for the hand when writing on the paper pad.



# Laying a Roof by Machine Saves Time



As the machine crosses the roof the liquid tar drips in front of the paper and a roller presses the paper into contact with the cement

**A** LABOR-SAVING device has been patented by which a large roof area may be covered with roofing material by means of an easily managed machine.

Where alternate layers of tar-paper and asphaltic pitch are to be spread

over a large area the process usually employed involves several separate operations. The tar is distributed and the paper unrolled upon it. Then the workmen must press down the paper until perfect contact is established. The machine carries a tank

filled with liquid pitch. A pipe conveys the liquid directly in front of a roller around which passes the sheet of tarred paper. This sheet is continually automatically unwound from a roll carried in the upper part of the machine.

As the machine is guided around by hand, it moves upon two large stable wheels and automatically permits enough pitch to flow in front of the paper-roller to cement it in contact with the roof. The weight of the roller presses the paper down upon the pitch. It is thus a simple matter to put on as many layers of the pitch and the paper as are required.

The machine can operate on a slanting as well as on a flat roof, though the pitch of the roof must, of course, not be too great. Any device that saves time also saves money, and the method of laying a roof by use of this labor-saving machine is an important economy.

## A Life-Line Gun that Can't Fail

**S**HIP aground off Cape Cod! In a short time life-savers stand on the beach, ready to hurl life-lines to the helpless vessel. Most life-line guns are fired by means of bags of powder that are rammed into the barrel. Should the powder get wet it will be useless.

But now there is a gun in which the projectile and the powder charge are connected. The powder is contained in a cylindrical water-tight cartridge-case at the base of the projectile. Tests were made in which the cartridge was immersed in water, both fresh and salt. When it was put into the barrel and fired, it went off without a moment's delay.

At the other end of the projectile there is a long stem to which the life-line is attached. The line is wound up in a tin can, so that it won't get twisted. When the projectile is shot off, the line goes with it.

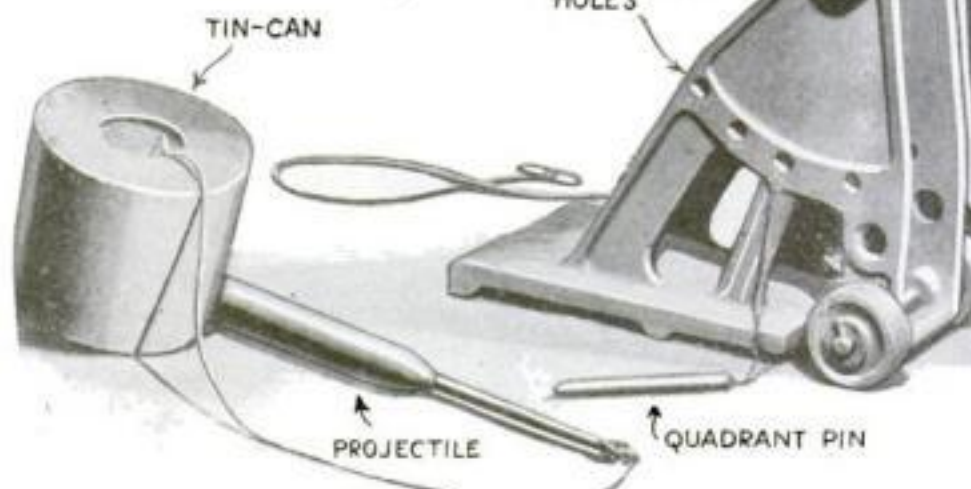
The gun itself is mounted on a heavy base, which is provided with two front



Showing how cartridge and projectile are connected in a new life-line gun

The projectile and powder are connected; the powder is placed in a water-tight cartridge in the projectile

wheels and teeth on its lower surface to lessen recoil when the gun is shot off. The muzzle may be elevated to any of these angles—thirty, forty-five, sixty, and eighty degrees.



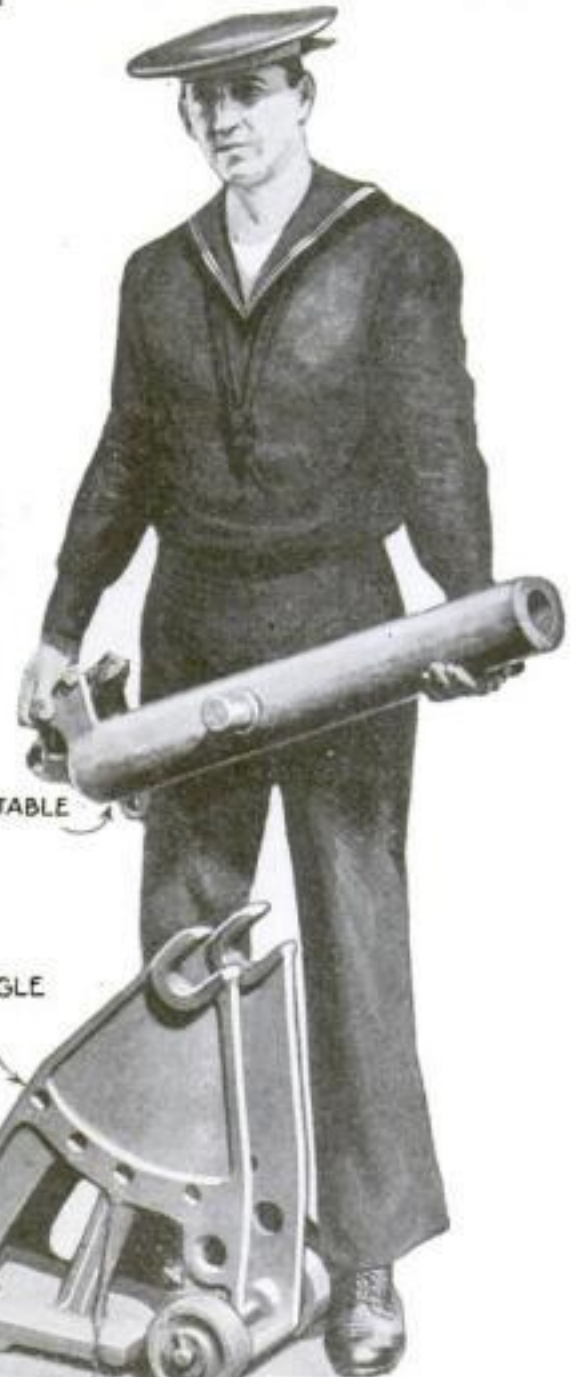
DEMOUNTABLE BARREL

4 GUN-ANGLE HOLES

TIN-CAN

PROJECTILE

QUADRANT PIN





# Rich Iron-Mines in Air We Breathe

Every year millions  
of dollars are lost  
in the cities' dust

By Edwin O. Pierce

**W**HEN is a city street an iron-mine?" The answer seems to be: "When the street is in a big iron and steel town."

A recent investigation of smoke and dust in Cleveland, Youngstown, Pittsburgh, and other centers of the iron industry revealed the fact that iron can be extracted not only from the dirt of streets, but from rugs and carpets, the walls and roofs of buildings, and even from the skins of the inhabitants!

The very air of these districts is laden with fine particles of iron dust, which, together with the soot, get into the eyes and lungs as well as upon the hands and face.

This investigation began with a microscopic examination of vacuum-sweeper dust, by which it was discovered that the dirt accumulating in a small rug in a day's time contained an amount of iron equaling a five-cent piece in weight. Other experiments were then made, demonstrating both by magnetic separations and by chemical analyses the presence of iron in the many places already mentioned.

Every kind of iron-furnace produces a certain amount of dust, but the larger part was traced to the Bessemer converters, which take molten iron from the blast-furnaces and change it into steel.

The Bessemer converters are great hooded pots having air-jets in the bottom and holding ten tons of metal. They are so mounted that they can be tilted to receive and pour out the charge. When the air is admitted, a huge saffron-colored cloud is the first result. This cloud contains the oxides of iron and manganese. Then a shower of sparks, called the "silica blow," is followed by a great tongue of flame about thirty feet high, due to the burning of the carbon.

Since these converters are like gigantic atomizers, they necessarily blow out a spray of molten iron and slag as well as oxidize the impurities. The tiny molten bubbles cool and harden as soon as they reach the air, but are carried considerable distances before they finally fall to the ground and are crushed into fine dust.



The "big brown smoke" coughed up by a Bessemer converter every few minutes. Without the prevention of iron-dust waste, fine particles of iron and manganese are blown into the air and are carried over an area of great extent



Picking up iron dust on the street! In the vicinity of the steel-mills quantities of iron dust are carried in the air and deposited in a fine powder over houses and streets. One can take a bar magnet along and collect much of this dust from the pavements

The amount of iron dust falling upon any given area is a difficult matter to determine exactly, but a series of dust-collecting experiments was made in the city of Youngstown, which is rapidly becoming the largest iron and steel center in the country. From the results of these experiments it was calculated that about sixty-five tons a day of actual iron from all sources falls upon an area of one mile radius in the heart of that city. And from this calculation it would follow that in the Youngstown district alone about one hundred and fifty to one hundred and seventy-five thousand tons of iron are blown away every year and lost to mankind forever.

To the value of the iron must be added that of the manganese, also lost. This is an expensive element of which the country has

very little. It is present in the blast-furnace iron, but in the Bessemer process we blow it away and then use money, ships, and men to get more, for it must be present in the finished steel.

There are a number of systems of dust collection. The best known method and the one that seems most suitable for iron dust is that of electromagnetic separation known as the Cottrell process. In employing this method the smoke is led through chambers in which are suspended long wires charged with electricity. A silent discharge is constantly taking place between these wires, and the particles in the smoke, also becoming charged, collect into groups and settle upon the wires or floor.

Because of its long flame and the necessity of being turned, the Bessemer converter is usually operated in the open. The problem of confining Bessemer smoke would seem to be a difficult one, but surely not beyond the bounds of American ingenuity. Once collected in a chamber, the separation of iron would be easy.

The iron dust could be heated until it became a solid mass or partly melted into solid pieces, and then returned to the blast-furnace.



From the sweepings of a vacuum cleaner used on a Youngstown, Ohio, rug the electromagnet draws to itself the iron particles, the dust that was carried through the air from the steel-mills



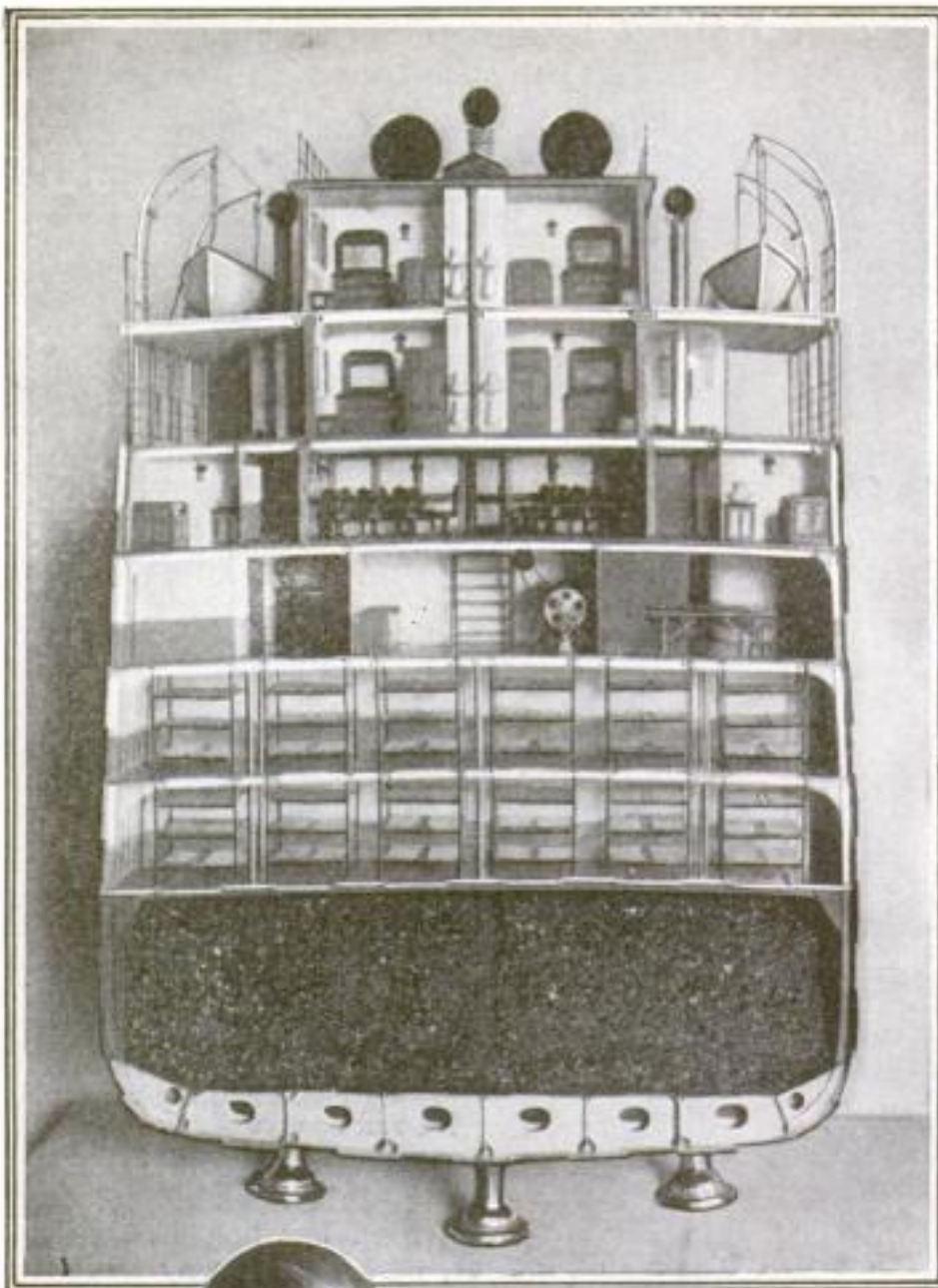
# Stay-at-Home Models of Ocean Travelers

The ship-owner's reference library

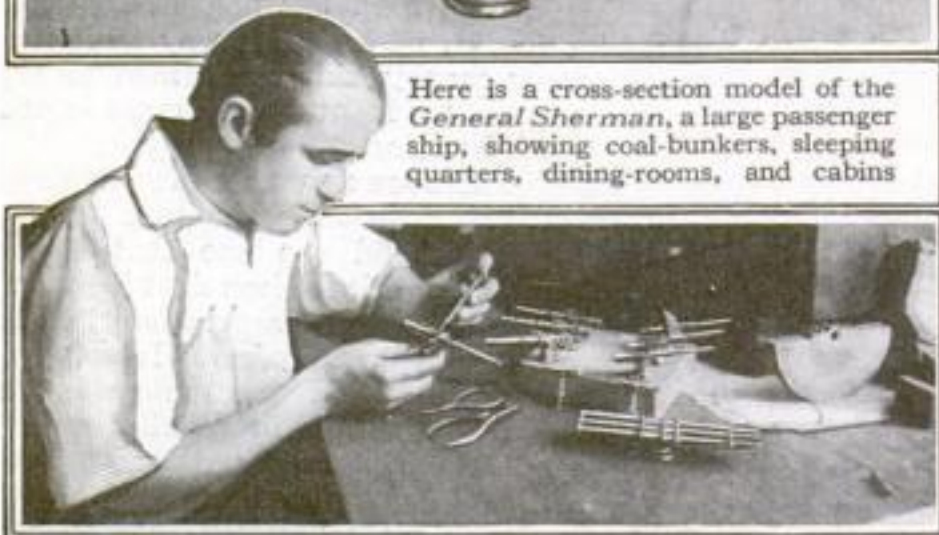
Photographs © Keystone View Co.



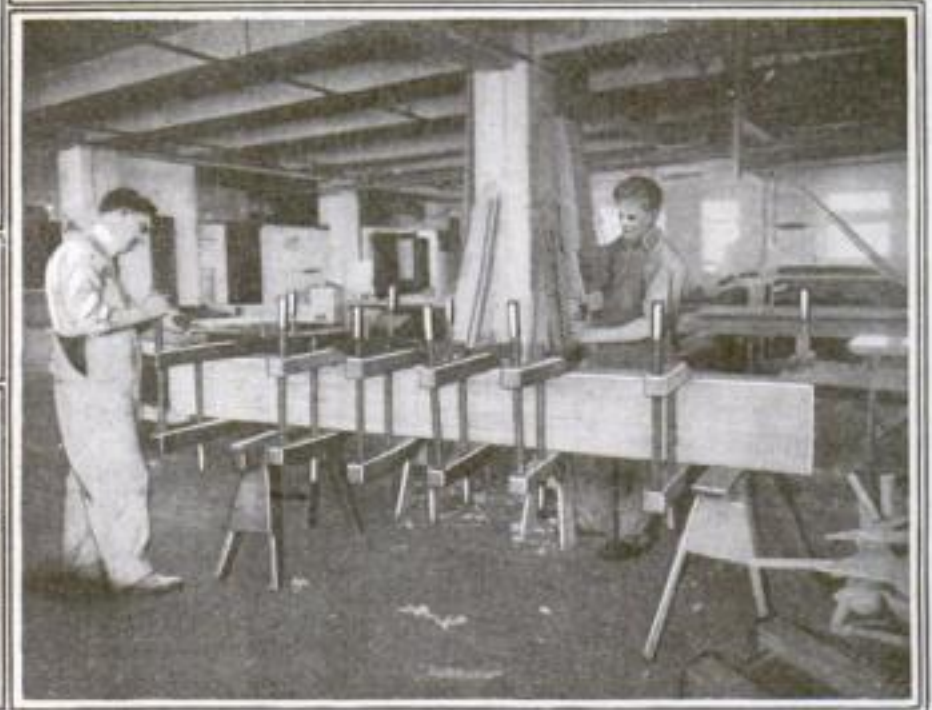
Blueprints, molds, and photographs of the parent ship are used for guidance in making models



Here is a cross-section model of the *General Sherman*, a large passenger ship, showing coal-bunkers, sleeping quarters, dining-rooms, and cabins



Even the guns of the battleships are modeled accurately. Of course they won't go off, but, for that matter, neither will the battleships



Wood that is well seasoned to prevent warping is selected, and the pieces are glued and set: this is the first process



Here is a ship that has just received its smokestack. Cabins and deck have already been carved out. There has been such a demand for model ships in recent years that one New York factory devotes all its time to making them



# Ask Dad—He Knows!

Once familiar things that have fallen behind in the march of progress



© Western Newspaper Union

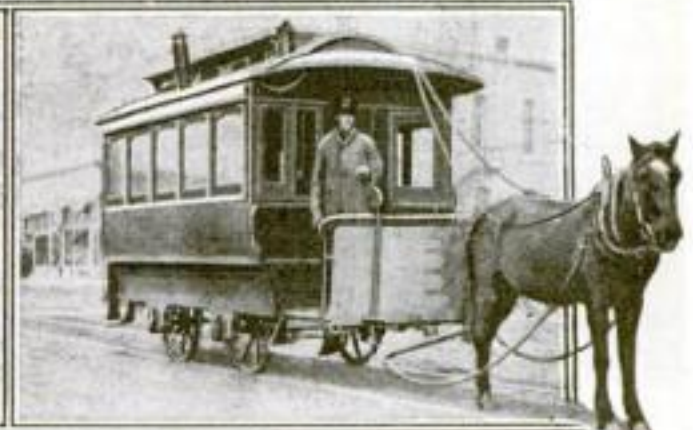
Chasing after fire engines was lots more fun when Dad was in knee-breeches than it is today. The high-spirited horses clattered down the street, shooting sparks and making much more noise than motor driven engines



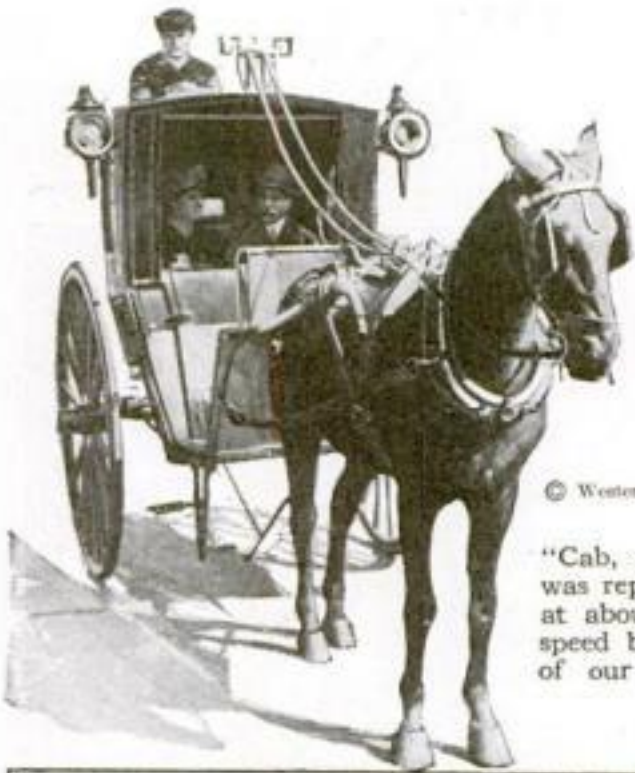
The wooden Indian! It used to stand boldly in front of each cigar store, staring sternly into space



When you wish to move, today, you hire a powerful moving-van. In father's—or perhaps granddad's—time, prairie schooners did the work



When Dad was a boy one of his ambitions was to drive a horse-car; but when he grew up the horse-car had disappeared almost entirely



© Western Newspaper Union

"Cab, sir?" That cry was replaced by "Taxi!" at about the time when speed became the slogan of our American cities



Dad practised archery when he was a boy. All the boys enjoyed it. Some of them still keep it up in Washington Park, Chicago



If Dad had wanted to go from San Diego to Silver City in the '90's he would have climbed onboard this rickety stage-coach

Across the river in an old-fashioned ferry-boat guided by a strong wire cable





# So Powerful Is This Searchlight that It Melts Lead

The metal liquefies at a distance of twelve feet

By Latimer J. Wilson



© Kadel & Herbert

So powerful is the beam of the Sperry searchlight that a cigarette can be lighted in the outer border of the rays. The sunlight is so closely rivaled in the new arc that moving pictures can be taken in it with the speed required for genuine sunlight

**H**OW bright is the sun? In candlepower the sun's intrinsic brightness, as seen at sea-level, is equal to the light of 270,000 candles for each square inch of its surface. The crater of an ordinary electric arc is equal to 84,000 candlepower on the same scale. Now the sun has a closer rival in the dazzling brilliance of the new Sperry searchlight, which has a total luminosity of 1,280,000,000 candlepower!

The rays of light from the arc are projected in parallel lines by a sixty-inch parabolic mirror. Allowing for the loss of light in reflection, the searchlight carried out into space would be visible at practically the same distance from the earth as would an equal area of the sun. A piece of the dazzling solar disk clipped into a circle sixty inches in diameter would have a rival in this searchlight. What a strange cosmic effect could be witnessed when the shaft of light sweeps across the sea to meet the rising sun!

Standing in the blinding path of rays emanating from opposite directions, the observer would notice that, for the first time in his life, he could stand in the direct sunlight without casting a shadow! The flame of the ordinary electric arc is itself cast as a shadow in sunlight when held a few feet from the ground. At a given

distance the beam of the Sperry searchlight is about equal to the total light of the sun when the latter is well up in the sky above the horizon. Concentrated against the light of the sun at such a time, the searchlight actually equals the sun, and becomes such a formidable rival that it can counterbalance the shadow-casting power of the great orb of day.

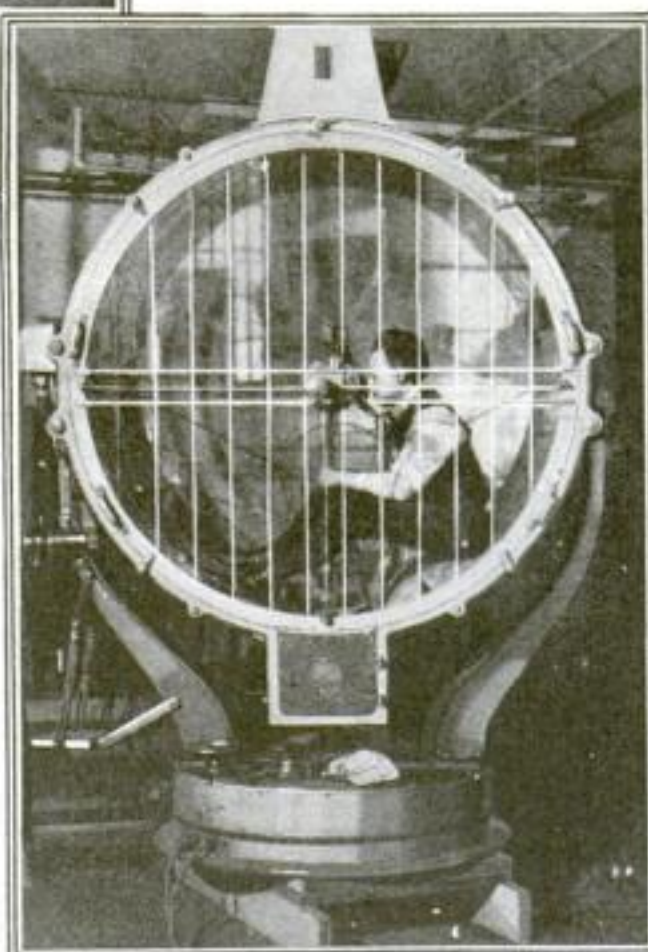
This marvel of searchlights was invented by Elmer A. Sperry. It consists of an automatically rotated positive

constant flame. The superior power of this new searchlight depends upon the intensity of the illumination of the gas which fills the crater of the positive arc. But for the device that makes possible the retention of a perfect crater whose image is projected in parallel rays from the huge sixty-inch mirror, the power of the arc would not have exceeded that of other searchlights.

One type of searchlight can be operated from a distance of ten miles. Stationed upon the summit of such a mountain as Pike's Peak, the control of the light could be managed from the city of Manitou at the base of the mountain. But it is customary for an operator to keep close watch upon the mechanism of these great searchlights while they are burning.

Of course, the light is far too bright for anyone to look at directly. An arrangement is provided by which the image of the carbons is projected sharply upon a ground glass at the side of the searchlight. The glass bears a vertical mark, and the rim of the crater must be kept exactly in line with this mark, thus showing that the crater itself is exactly in the focus of the parabolic reflector. So powerful are the rays that lead can be melted at a distance of twelve feet from the crater. A cigarette can be lighted at the edge of the beam of light.

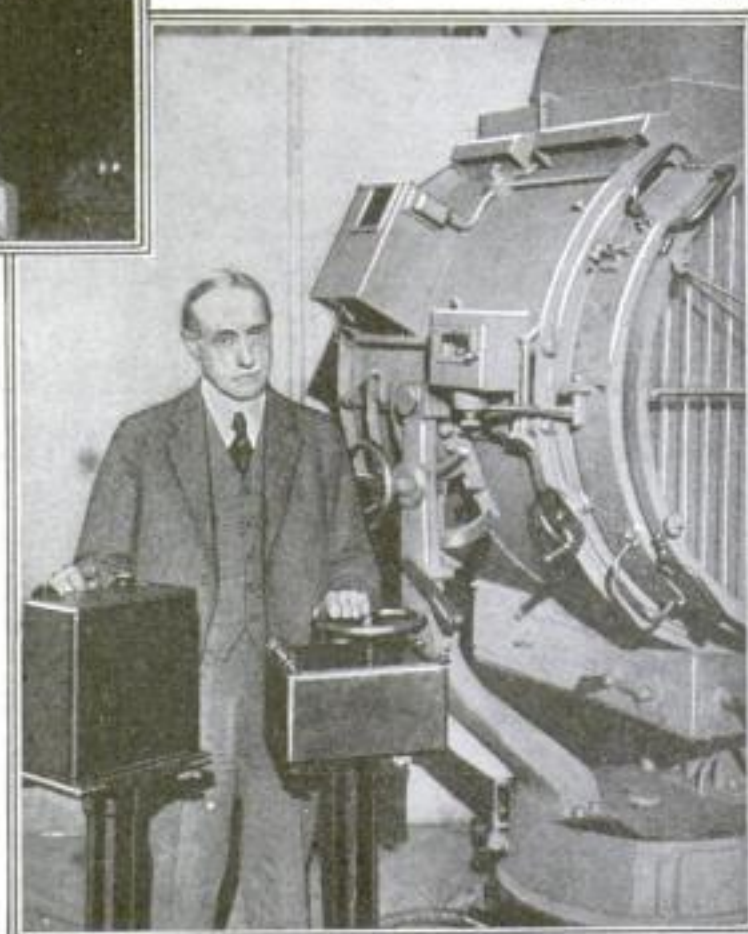
© Kadel & Herbert



© Kadel & Herbert

The largest searchlight. It has a candlepower of intrinsic brightness about equal to the sun itself, area for area. The size of the reflector may be judged by comparing it with the man

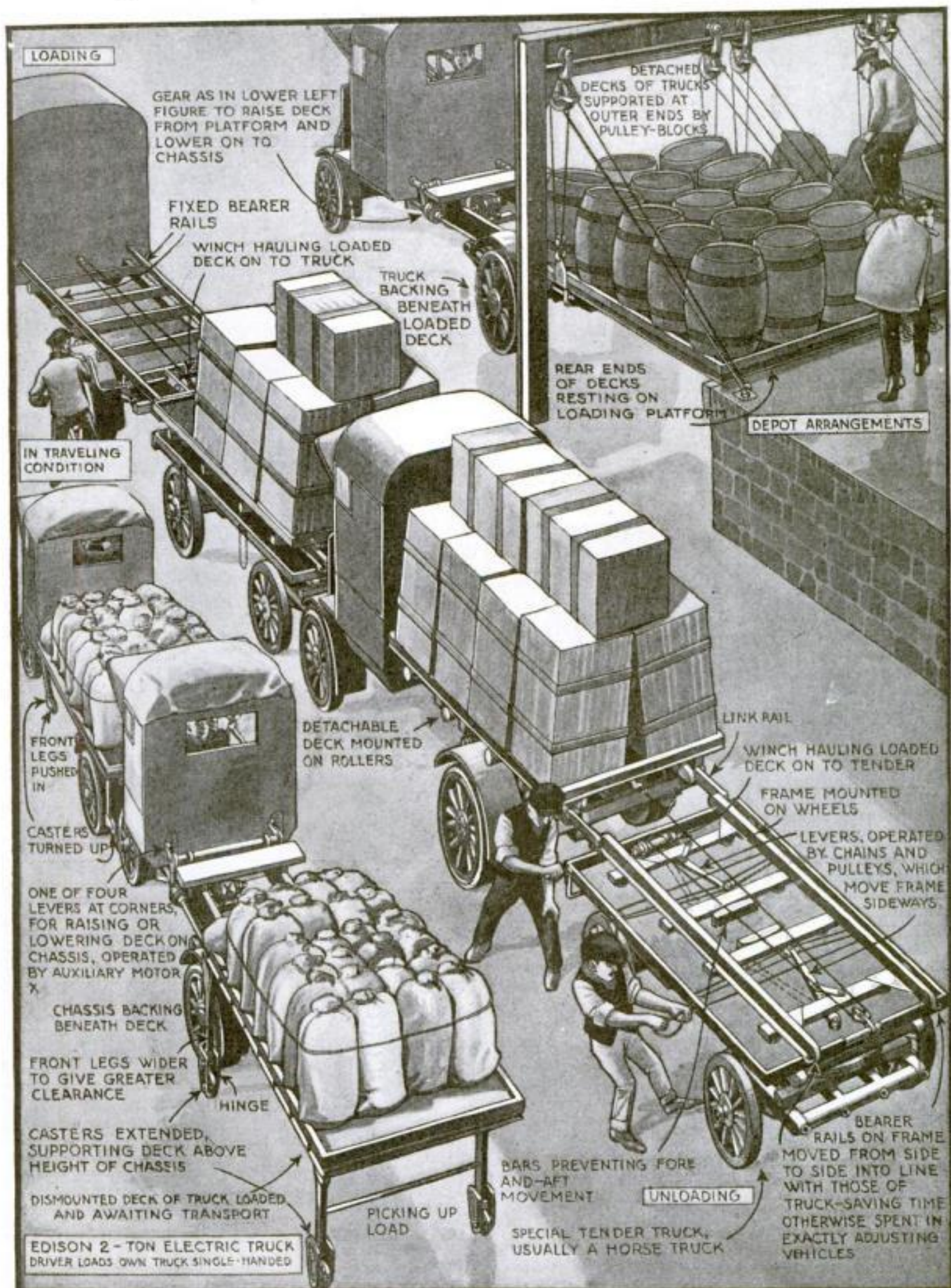
cored carbon which burns to a crater-tip. The negative carbon is held by silver-tipped "fingers," while the positive is held in an airtight clamp tipped with quartz-crystal. The hot air is blown off by a motor-driven mechanism to keep the carbons and the great parabolic mirror at a safe temperature. The carbons are held at the proper distance apart and are automatically fed to keep a



The Sperry searchlight of this type can be operated by electric controls ten miles distant. Mr. Elmer A. Sperry, the inventor, is shown operating the controls



# A Quick Method of Loading Motor-Trucks



**W**HEN a motor-truck has to stand at the loading depot and wait until the boxes, bags, or barrels that comprise its load are packed upon it, the working time of the truck is enormously shortened. But if the body of the truck consists of a movable deck that can be readily and quickly slipped on and off, all the time that is lost in loading and unloading is the time required in removing and replacing the already loaded deck.

To relieve the congestion of rail transportation by quickly handling the loads of motor-trucks, or "lorries," the use of these adjustable decks has been suggested by Mr. Conradi in a paper that he recently read before the Institution of Mechanical Engineers in London. The

method enables a single workman to dismount and replace the body or deck of his truck in about five minutes' time.

A platform supported by two casters at the front and two at the rear is easily moved from the room where it is loaded, up to the back of a truck. The frame of the truck carries a pair of rails upon which the loaded deck can be slid and locked firmly. The frame of the platform also holds two rails to receive the deck of the empty truck when it returns for a new load. Workmen in the depot load the "decks," making them ready to be rolled over to where the trucks are coming to receive them. The illustration shows the stages in the process of loading and unloading with the adjustable decks.





Unscrew the cap on this fountain-pen and out pops a drinking-cup

## A Fountain-Pen Cup

JUST as a fan will pop out of a toy gun, so a drinking-cup will pop out of a toy fountain-pen, the invention of Mr. James H. Watson, of New York city. The holder is made of hard black rubber and looks just like a fountain-pen. It can be clipped to the vest pocket and be entirely out of the way until it is needed.

When you want a drink, you unscrew a cap that fits over the end of the water-container. Out pops the cup, which is cone-shaped and is attached to a spring metal frame.

The cup is made of the usual waterproof paper and may be easily replaced by a new one when the old cup wears out.

The inventor of the fountain-pen cup designed it especially for travelers.

## She Sells Phonograph Records by Telephone

"I'll take that—send it as soon as you can," says the lady at one end of the wire; whereupon the lady at the other end wraps it up. Wraps what up? A phonograph record.

With the help of a new amplifier, phonograph records can be distinctly heard over the telephone. The amplifier is placed between the phonograph and the mouth-piece of the telephone, and is connected with an electric circuit. When a new record is set in motion the buyer at the other end of the wire hears the production plainly and can readily tell whether or not she wants it.

An amplifier placed between phonograph and telephone enables the person at the other end to hear and decide whether to buy it

## Safety Devices to Guard the Power Press Worker

THE power press has a bad reputation. It has caused more accidents than almost any other machine. But now it is being equipped with safety devices that make accidents almost impossible.

Take, for example, the press that punches lids for tin cans. The lids are placed on an endless chain (B) by the operator, and she stands at least five feet away from the press itself. The chain carries the lids to the punch. Wings (A) automatically open and close, feeding the lids to the punch one at a time. Hundreds of lids are stored in a tray (C).

And now consider the press that cuts small perforations in tin can lids—most cans of cleaning powder are provided with these lids. The operator places the smooth lid on a block (A) that is located in front of the punch. Between the two is a glass safety guard (B) that protects the operator and yet enables her to see what is going on in the press.

When she steps on a lever the lid promptly slides under the glass guard and takes its place in the press, and then the punch comes down.



(Left) The operator is perfectly safe when she punches tin can lids in this press. She feeds them to the press on an endless chain. (Right) When a lid must be perforated, it is placed on a block located in front of the press, but separated from it by a glass guard. It is operated by a pedal



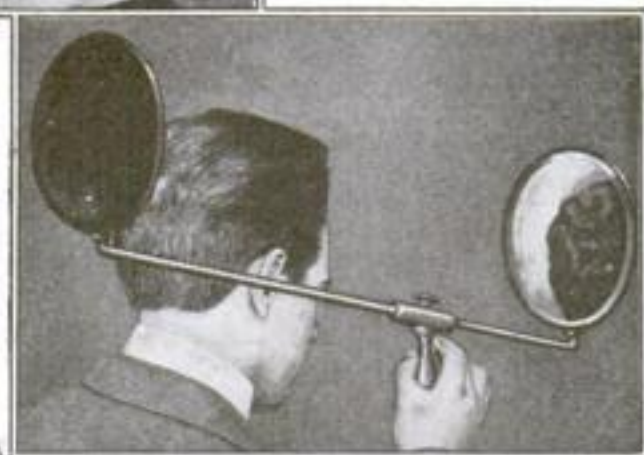
The celluloid window-shade keeps out drafts but not the sunshine

## Air Without Drafts

A NEW arrival among shades is the celluloid window-shade, used to keep out drafts. It is fastened to a regular spring shade roller and has the customary stick through its lower end.

You attach it to the top of the window-frame just as you would an ordinary shade. Being transparent, it does not obstruct the view.

The ends of the stick may be fitted in grooves in the frame to keep the celluloid from curling.



With this mirror you can keep an eye on the back of your head

## As Others See It

EVEN though the back of your head is not so interesting as the front, you may occasionally like to look at it. One mirror won't help you out, but two of them, properly placed, will show you just what the back of your head is doing.

Edward H. Roy, of Nashville, Tenn., has invented a special duplicate mirror. The two mirrors are fastened to the ends of an arc-shaped bar so that they converge slightly toward each other. A handle is attached to the center of the bar.





An enterprising shoe-polish manufacturer offers a prize of \$1,000 for an improvement on this device

## \$1,000 Reward

**WANTED:** a shoe-polish box opener that will permit the box to remain airtight, that will work indefinitely without breaking off, and that will always be in order. Any person with a mechanical turn of mind has a chance to improve the device at present being used and, incidentally, make the neat sum of \$1,000.

The volatile ingredients in the shoe-polish must be protected by an air-tight box. If rivets are put in the metal it is scarcely practical to prevent the container from leaking and permitting the vapors to escape. To keep the device from breaking off and yet not to have it riveted can be expressed thus: "Ah! There's the rub."

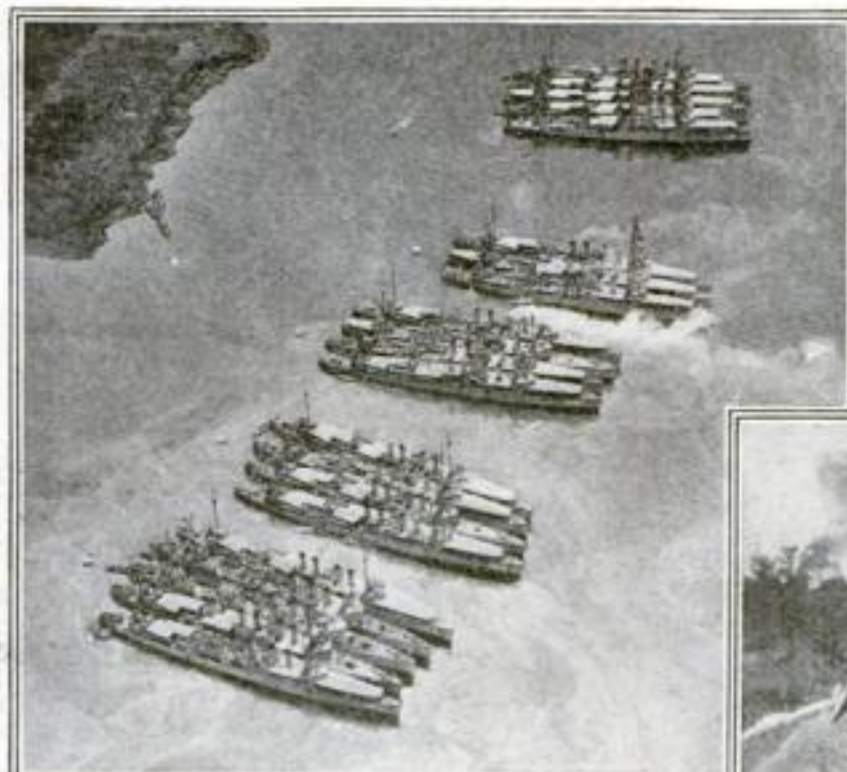
Twenty-one United States destroyers are grouped here just off the Pacific end of the Panama Canal

## These Harmless-Looking Boats Are Destroyers

**VIEWED** from an airplane, the twenty-one ships in the picture below look like a small boy's highly prized collection of toy boats in a mimic sea. They are United States destroyers at anchor just outside the entrance to the Panama Canal, and at that distance they look very harmless. Needless to say, they are not.

The boats are arranged in five groups, and all of the boats in each group are anchored to one buoy. They are lashed together, but have fenders between them to keep them from bumping into each other.

They are located off Balboa, which lies at the Pacific end of the Canal. They are only a very small part of the destroyer force of the Pacific Fleet.



Paraguayans drinking maté, a kind of tea that grows in South America

## They Love Their Tea

"LET'S have some tea," says the woolly South American savage to his brethren, and they run for their tea-cups.

Paraguay tea, known as maté, is widely used in South America. In country districts the natives drink their maté through a thin metal tube thrust into a sun-dried gourd. A sieve inside of the metal tube holds the tea-leaves in their place.



An invention of Robert E. Bressler, of Indiana, for speeding up the work on railway road-beds

## Clearing the Railway Right of Way

**INSTEAD** of having a gang of many workmen going along the side of the railroad-bed shoveling away the dirt and rocks, while construction work is under way, a ditching mechanism has been devised to do the work with less trouble.

A side wing is mounted in a rearwardly inclined position on the construction car, and is pivoted, together with a carrying wing, so that it can collect the dirt as the car moves along through deep cuts, distributing it when the end of the cut is reached.

A heavy arm adjustably controls these "scrapers" and is operated by an air cylinder. It is an easy matter to adjust the slope of the "wings" to accommodate the slope of the ground at the side of the road-bed for drainage.

The machine does the work of many workmen and can travel through ditches at two and a half miles an hour.



Protected from giant boulders, this little house has stood for years in the mountains of Portugal

## Boulders to Right of It, Boulders to Left of It

**ON** THE top of a hill a Portuguese goat-herdsman built himself a tiny house. There were no trees near by to shelter it from wind and storm, yet the house has stood for many years.

Boulders under it, on top of it, and all around it keep it firm. The walls are studded with small rocks; the roof at the rear of the house is weighted down with them. There's a boulder in front of the main entrance, another at the back door, and more along the sides.

The boulder house is situated in the Serra da Estrella mountains. Goats are raised throughout these mountains and the cheese made from their milk is very delicious.

The interesting question arises, "How did the boulders get there?" The smoothness of their form indicates the violent action of wind and water and the glacial currents that probably bore them down from lofty summits. Many times have they saved the cottage from the wind's fury.



# He Has Built Fame with Cardboard

Berthold Audsley won success by finding a need and filling it

By Herbert Asbury

THE children who visit the Newark, N. J., Public Library and Museum know Berthold Audsley as the tall, kindly man who always has a twinkle in his eye, and who makes such wonderful locomotives, Indian tepees, medieval castles, and all sorts of interesting things out of cardboard and metal; and a few of the grown-ups in Newark, where he works, and in Bloomfield, where he lives, know him as the man who is in charge of the art work at the Museum. But there are others—few in comparison, perhaps—who know Mr. Audsley for what he really is—architect, designer, interior decorator, artist, and probably the foremost cardboard modeler in the world—assuredly the foremost in the United States.

## An International Name

In the world of art and architecture Mr. Audsley's reputation and fame as a worker in cardboard are international. It requires but one glance at some of his creations to know why. His castles and his churches and his buildings of all sorts, all of them constructed entirely of cardboard and painted to resemble exactly the original structure, are marvels of intricate detail and faithful adherence to the original design.

It is actually impossible to distinguish between the photographs of the original structures and the photographs of Mr. Audsley's models. The writer failed in several attempts of this sort, scoring not a single time from a pile of pictures. One of these photographs was that of a model which Mr. Audsley had made for Gorham & Company, the New York jewelry and silversmith house, of the interior of the Lady Chapel of St. Paul's Church in Brooklyn, which was constructed by Gorham & Company's ecclesiastical department.

The model of St. Paul's Lady Chapel is one of the finest that Mr. Audsley has ever made, and it is an exact duplicate, in cardboard and in miniature, of the original chapel. It contains several thousand pieces of cardboard, and is three feet high, three feet deep, and eighteen inches wide, and drawn exactly to scale in every detail.



Combined skill of hand and brain enabled Berthold Audsley to build up an international reputation as a maker of cardboard models. He turned a hobby into a new profession

Mr. Audsley began his work in cardboard modeling some eighteen years ago. Architects and artists and designers and constructors of churches and buildings of that sort have great need for accurate cardboard models, and the demand so exceeded the supply that Mr. Audsley began doing some of his own modeling. He took it up first largely as a hobby; but his interest in it grew to such an extent that the work soon became a part of his profession, and eventually practically his entire time was devoted to it, with the exception of that given to his work in the Newark Museum.

## Models for England and America

During the last few years Mr. Audsley has executed commissions for firms both in the United States and in England, besides constructing many models for his own pleasure. He is now engaged on a museum piece, a model of the ancient dungeons of the Chateau Corcy, which was destroyed when the German army invaded France. This model will be complete in every detail

and will show the dungeons in color according to the original designs and the records of the chateau. When it is completed it will contain between 7,000 and 8,000 pieces of cardboard.

Mr. Audsley uses virtually nothing in his work but cardboard, although he has made the designs for a number of models in metal, assembling them after the pieces were cast. One especially fine example of this sort of work is a locomotive, oil-burning and capable of pulling several hundred pounds, which is on exhibition in the Newark Museum.

He doesn't do any work in wood, excepting to fit into his model a piece of wood where cardboard would not answer the purpose. But this is done so seldom as to amount to nothing.

## Infinite Detail Necessary

The technique of this work in cardboard is replete with infinite detail and exactness. Every piece of cardboard that goes into a model must be cut exactly to scale and must be extraordinarily accurate in measurement. An error of

the tiniest fraction of an inch will grow, since the model is cut and assembled until it reaches what by comparison are gigantic proportions, and a slight miscalculation will necessitate the recutting of entire sections or groups of the design.

## How He Does It

The first thing that Mr. Audsley does when he begins a cardboard model is to make drawings to scale, even down to thirty-two feet to the inch, which is the smallest he has ever attempted. These must be exact working drawings, as accurate and as correct in every detail as the working plans of an architect, and they must show every joint and wall and angle in terms of cardboard thickness.

After he has finished this task he divides the design into groups and sections, each of which is numbered and lettered, so that when the time comes for assembling he will know instantly just where every piece belongs. For instance, if a certain side-wall is in Group A, and is to be of four thick-



nesses of cardboard, it is so indicated on the drawings, and marked A-1, A-2, etc.

This being completed, Mr. Audsley makes blueprints of his building, and obtains elevations, all exactly accurate and correct; after which he plots the entire design on great sheets of cardboard. They are then ready for cutting.

This he does on plate-glass with a

very sharp knife; and as each piece is cut, marked, and numbered according to the drawings and blueprints, it is thrown into a big basket. Later the pieces are divided into groups, and when each group is complete the model is ready for assembling. The joints are grooved and tongued and made to fit exactly in all manner of ways; and where it is necessary they and the various pieces that go to make up the

required thicknesses are glued with pure gum arabic, which Mr. Audsley has found by experiment is best suited to his work. To prevent the bending and buckling that is so frequently found when cardboard is glued together he simply gums from the center out.

The model is then ready for painting, and after that it is ready for exhibition.

## He Got Ten Thousand Dollars for an Idea

A. S. Wysong made brains beat hard luck

**T**EN thousand dollars for the best walnut-branding machine."

When Mr. A. S. Wysong, of Los Angeles, heard of this offer, he was nearly penniless. He had just been released from war service, and at almost the same moment he received word that a Utah mine he owned had unfortunately caved in.

### *Already an Inventor*

He didn't know much about walnuts, and he had never branded anything, but he wanted that ten thousand. The prize was offered by the California Walnut Growers' Association, and when Mr. Wysong heard of it the closing date was only a few weeks off.

Fortunately, he knew a great deal about machines. He had worked around them ever since he was a boy, and had invented one of the first light-weight tractors. During the war he served as a machinist's mate. His uncle was a well known inventor, and Wysong himself had taken out about thirty patents.

### *Prints With Rubber Balls*

He studied walnuts. The rough, irregular shell would not be easy to brand. But of one thing he was sure: he would use the printing press as a model from which to make his branding-machine.

He decided that, instead of using a hard roll for the actual printing, he would stud the press with soft rubber balls. Thus, as each ball pressed against its corresponding walnut, the ink on the ball would reach all the high and low spots on the walnut's shell.

He arranged the balls around the

roll in seven rows of three each, and used a rotary feed drum that would hold nuts of all sizes. When his branding-machine was set in motion, ink was spread on the roll that bore the etched brand marks, and this ink was trans-

and quick-drying qualities for his purpose.

Then there was the question of heat. If the rolls became too hot the rubber balls would melt. So he attached a water-cooling system to the machine that kept everything running at a temperature of sixty-five degrees. All the while he worked on it, his curious neighbors would stand around and hold long dissertations on nuts in general. But he continued to plug away.

In the first place, he wanted that ten thousand. Then, his wife had told all the neighbors that he was going to win the prize. He simply had to win.

### *Just in Time*

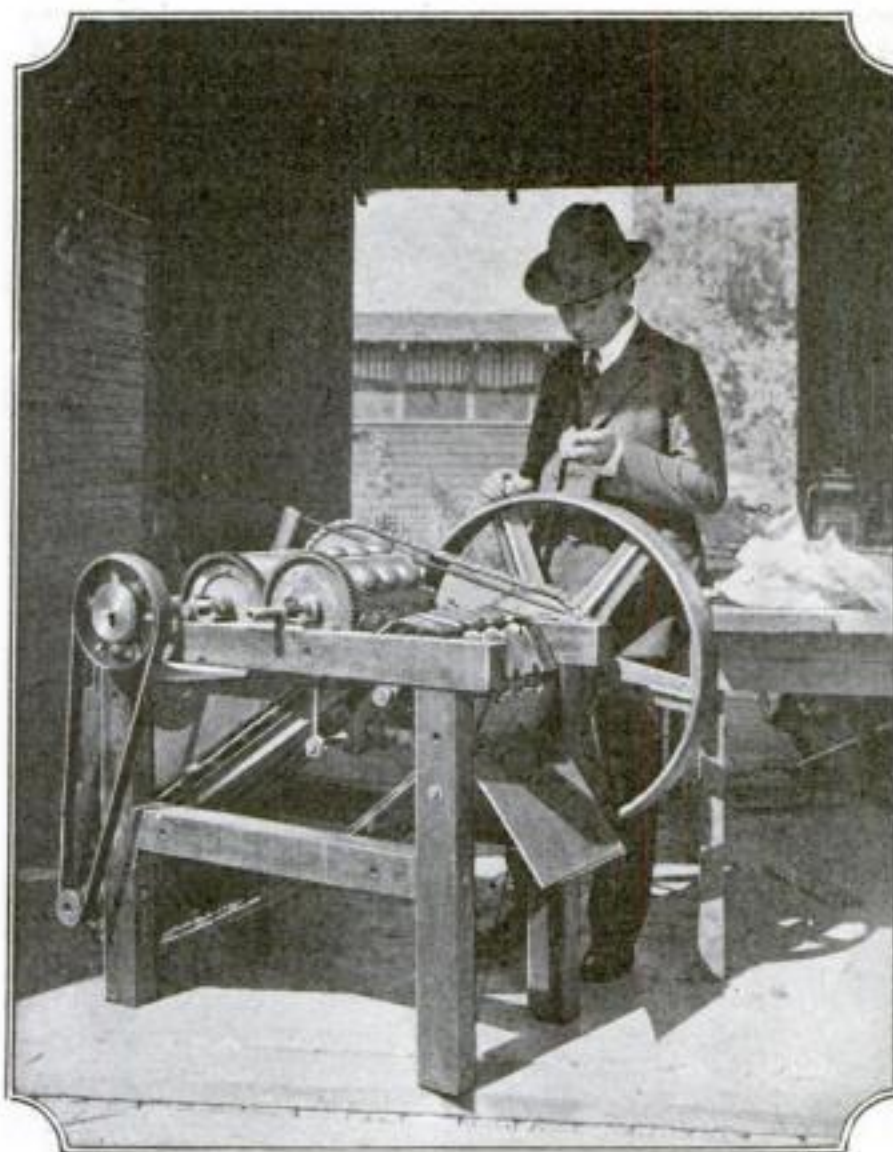
He worked day and night, and handed in his model a few minutes before the contest closed. There were one hundred and twenty-seven models in all. Most of them did not have proper cooling systems. Mr. Wysong won the prize.

He took a long, much-needed sleep, and then he immediately got busy on an orange-branding machine, which he subsequently also patented.

Now the money is rolling in. This summer he intends to visit the mine that caved in at the beginning of this story and see if he can cave it out again. There is a fine trout stream near the mine, and in his leisure moments

Mr. Wysong is going fishing.

"I've wanted to take a vacation and go fishing all my life," says he, "and now I'm going to do it. I've ceased being the 'poor relation' in our family, and hereafter A. S. Wysong is going to catch trout every year, even if he has to invent a new kind of hook to catch 'em with."



This is A. S. Wysong, who won a ten-thousand-dollar prize for inventing a walnut-branding machine. He feeds walnuts to the machine three at a time, and the brand is stamped on them by means of soft rubber balls that sink into all the crevices in the rough shells

ferred to the rubber balls, and then to the nuts.

Mr. Wysong tells us that he had very little trouble getting together the mechanical parts of the machine. His difficulty lay in getting the proper ink. He experimented with a hundred different formulas before he found a mixture with the necessary lubricative



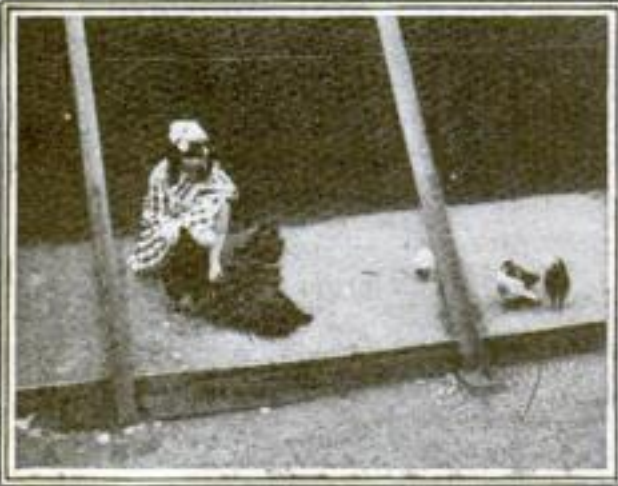
# Things You Can Do with a Roof

How the great waste spaces atop our buildings can be made useful



You can do almost anything with a roof, as the pictures below show. Mr. Gompert, a New York architect,

lives in a cottage on top of an office building. When the wind blows, we imagine he is well aware of it



Anita Surridge raises chickens on her roof. They are caged in, lest they fly over the side of the building



There is at least one leakless roof in the world; it's on top of a London store: a rowing instructor gives lessons there



Your roof may be turned into a hand-ball court—if the people on the top floor don't object. But the players should be warned that a ball thrown over the fence is irrevocably lost



Anita wasn't satisfied with raising chickens, so she started raising cabbages in two feet of dirt. Seeds don't know the difference between a bed in the ground and a bed on the roof



# Lightening the Burdens of a Bachelor

Electricity has saved many of them from desperate marriages



When your quarters need cleaning and polishing, Mr. Bachelor, do your own polishing with an electric motor having soft felt strapped to the drive-shaft



No matches to light the gas with? That's easy. Attach a knife-sharpener to your motor and touch it to the stove after you have turned on the gas. Sparks! Flames!



When your shoes need shining, get a small motor, wrap a felt polisher around the shaft, and step on the switch



With an electric toaster and a percolator you can get your breakfast. You don't like to cook your own breakfast? Neither do many married men



A wife and an electric iron go on the rampage at sight of a creased tie. Fireworks! But a bachelor devises substitutes



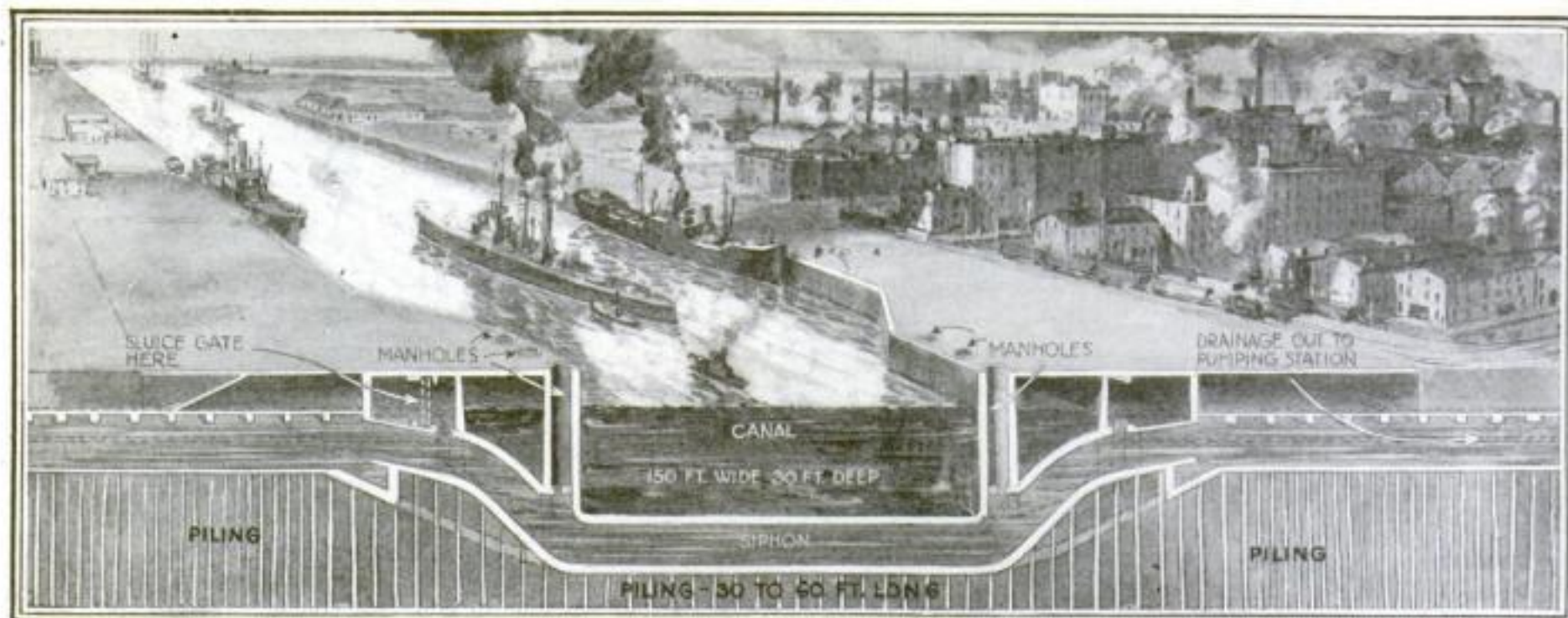
If you are a really truly woman-hating bachelor and won't even go near a manicurist, you can polish your own nails by using that same old motor and a felt buffer

If you come home late at night and feel like eating beans, open a can and heat them on the electric immersion heater. No one will stop you

Some wives will iron trousers, others not. But a glass of water, a handkerchief, and an electric immersion heater will always do the job right







How the lock of the Industrial Canal will look when completed. The elaborate series of gates, each weighing 200 tons, is shown; also the emergency dam with the 300-horsepower crane to drop the sections across the lock

## One Canal Dives Under Another

### Building a ship-canal through treacherous quicksand beds

By Thomas Ewing Dabney

A SHIP-CANAL 30 feet deep and 300 feet wide is being built at New Orleans to connect the Mississippi River with Lake Ponchartrain. Twelve million dollars has been spent on it, and before it is finished, which should be within another year or eighteen months, it is probable that it will have cost twenty millions. Its purpose is to shorten the steamship distance between New Orleans and the Gulf, and to provide industrial sites on a fixed-level waterway, and also to develop an extension of the wharf facilities of New Orleans, wharfs being built on the canal at one quarter the cost on the river.

To carry out the plan, a soil problem never before encountered on such a scale had to be solved, and the greatest siphon in the United States built. Both achievements were marvels of engineering skill. To dig a canal through beds of quicksand, and to effect a crossing between a drainage canal and the ship-canal so that the drainage canal would actually go down under the latter and come up again, were problems seemingly hopeless to solve. This is how the difficulty will be surmounted.

Because of the difference in the level of the river and the lake, a lock must be built. This will be of steel and reinforced concrete. Designed to accommodate ships of 10,000 tons and drawing 30 feet of

water, the over-all dimensions of this lock are: length, 1,020 feet; width, 150 feet; height, 68 feet. The usable dimensions are 600 by 75 by 30 feet. The top of the lock will be 6 feet above the highest record stage of the Mississippi, and the floor will be laid 45 feet below the ground surface.

It requires a greater excavation than has ever been attempted in this region, underlain as it is by quicksands, which are forced into a cut by the pressure of the earth, the water pressure of the river and gulf, and the natural gas pressure. Many engineers said it could not be done.

George W. Goethals and Company, of New York, the engineers in charge of the work, began an excavation 750 feet wide by 1,500 feet long, gradually sloping the cut toward the center in an effort to prevent slides. Where the excavation began, a ring of sheet piling was driven to hold back the first stratum of quicksands. About 150 feet farther in, another ring of sheet piling was driven through the

second stratum of quicksands. Then Goethals started the delicate task of driving the center cut for the lock.

The pressure proved greater and the sands more liquid than had been anticipated. In May, 1919, the sides of the excavation began to cave in. The quicksands, running through the sheet piling as through a sieve, flowed in as fast as the dredge could pump them out; and the gas pressure threatened to blow through the bottom of the lock site.

Water to the depth of 30 feet was pumped into the excavation. Its weight counterbalanced the combined pressures. Then wells were driven to relieve the gas pressure; a ring of steel sheet piling was put down to hold back the quicksands, and braced apart by thousands of 10-inch timbers; on these the pile-drivers were erected, and drove the foundation piles in the water as deep as possible.

The water was then pumped out. This was done very gradually, while a corps of engineers and experts watched every timber.

Only one section of the side walls moved—about three inches. Then the braces caught. The flow of quicksands was stopped. The gas pressure was relieved.

These piles are now being followed down.

They are 60 feet long and there are 14,000 of them. An extraordinary foundation is needed to sustain the weight of the

#### "It Can't Be Done"

*The sides of the excavation began to cave in, the quicksand rising through the sheet piling as through a sieve—and the gas pressure threatened to blow through the bottom of the lock site.*

*A hopeless job? That's what many engineers said, shaking their heads with the world-old "it-can't-be-done" motion. But there's always an industrial general with all the punch of a Foch or a Grant and all the strategy of a Napoleon. That's why the unending battle in which man pits himself against the forces of nature has gone steadily in man's favor.*

*When you read "One Canal Dives Under Another" it might be worth while to remember that, but for science, we should all of us still be living in caves and grubbing roots.*



lock—225,000 tons when empty, or 350,000 tons when filled with water.

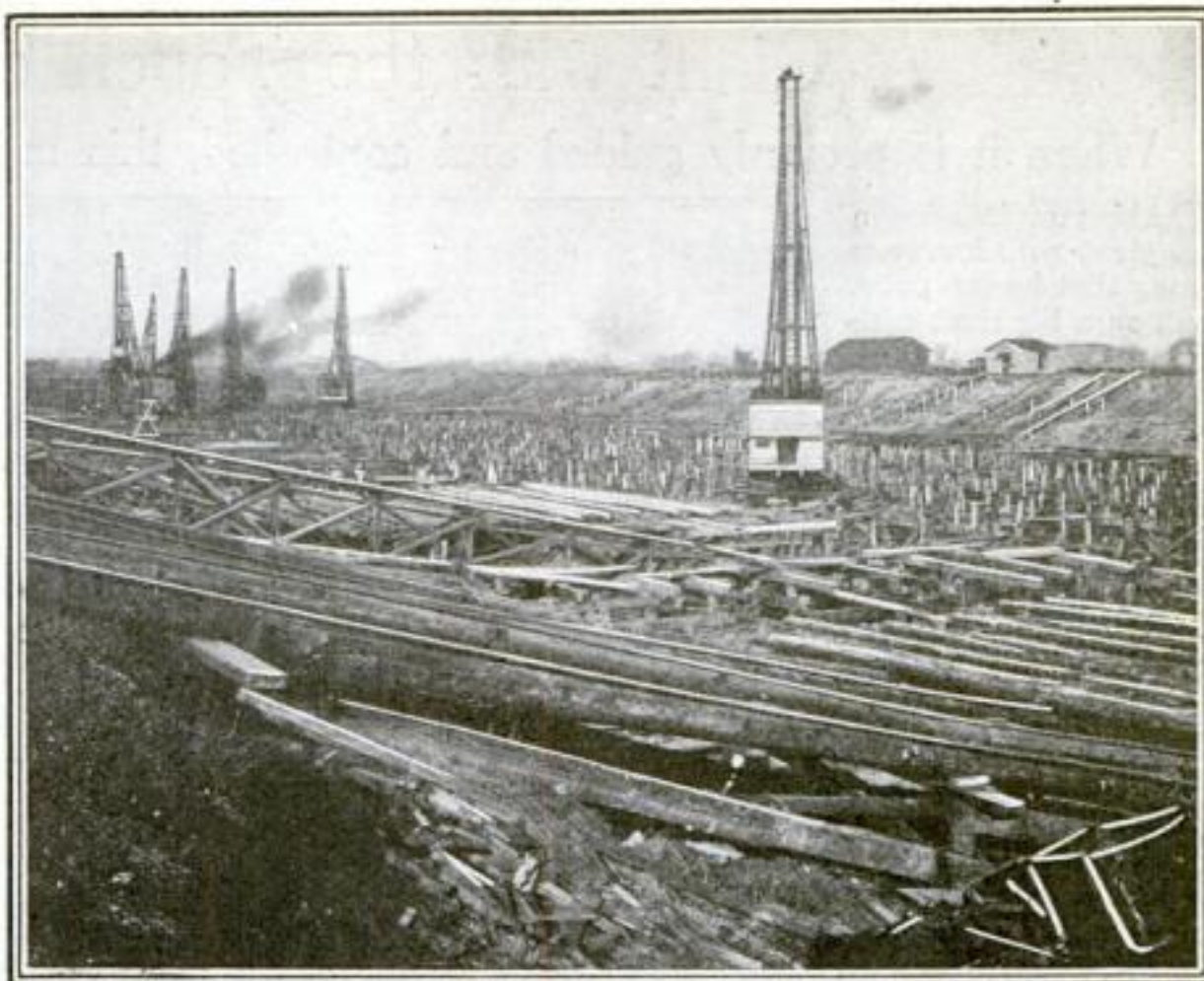
The floor will be 10 or 12 feet thick. It will be laid in 15-foot sections, for only a few of the braces can be removed at a time. The walls will be 13 feet thick at the bottom and 2 feet at the top. One hundred thousand yards of concrete will be used in the lock.

The ground will be sloped to the top of the lock wall on a 150-foot terrace, to brace the walls against the weight of water within. There will be huge anchor columns of concrete to hold the walls against the weight of earth when the lock is empty.

The lock will have five sets of gates, built of steel plates,  $4\frac{1}{2}$  feet thick and weighing 200 tons a gate. Four sets of these gates will be of the 55-foot size; one set of the 42-foot size. Each gate will be operated by a 52-horsepower motor. There will be an emergency dam, consisting of eight girders, 80 feet long, 3 feet wide, and 6 feet high, and weighing 90 tons each. A crane, operated by a 300-horsepower motor, will be able to drop them into slots in the lock walls, across the lock entrance, in an hour.

Two channels, each measuring 8 by 10 feet, cast into the base of the lock, will fill and empty it in twenty minutes. Openings will be controlled by eight sluice-gates, each operated by a 52-horsepower motor.

Six capstans, two at each end of the lock and two in the middle, will work ships in and out of the lock.



Looking into the excavation for the remarkable ship-lock. Note the thousands of piles driven to sustain the weight of the 350,000 tons of concrete and steel. The excavation extends 40 feet below the tops of the piling

Each capstan will be operated by a 52-horsepower motor, and will develop a pull of 35,000 pounds.

Concrete will be laid at an average rate of 400 yards a day, according to the estimate of engineers. Three railroad trestles are being built over the excavation to accommodate the concrete trains.

The concrete on this job will cost, laid, about \$2,225,000; the mechanical equipment, \$1,516,900. If the lock is to be finished by March, 1921, a force of 2,000 men will have to be employed continuously. Their pay-roll will be about \$2,500,000. Difficulty is being encountered in getting that number of properly qualified men together. According to present estimates, the total cost of the lock will be in the neighborhood of \$7,500,000.

The Industrial Canal crosses one of the city's drainage canals. This is the Florida Avenue canal, leading into Bayou Bienvenue. This rendered necessary the construction

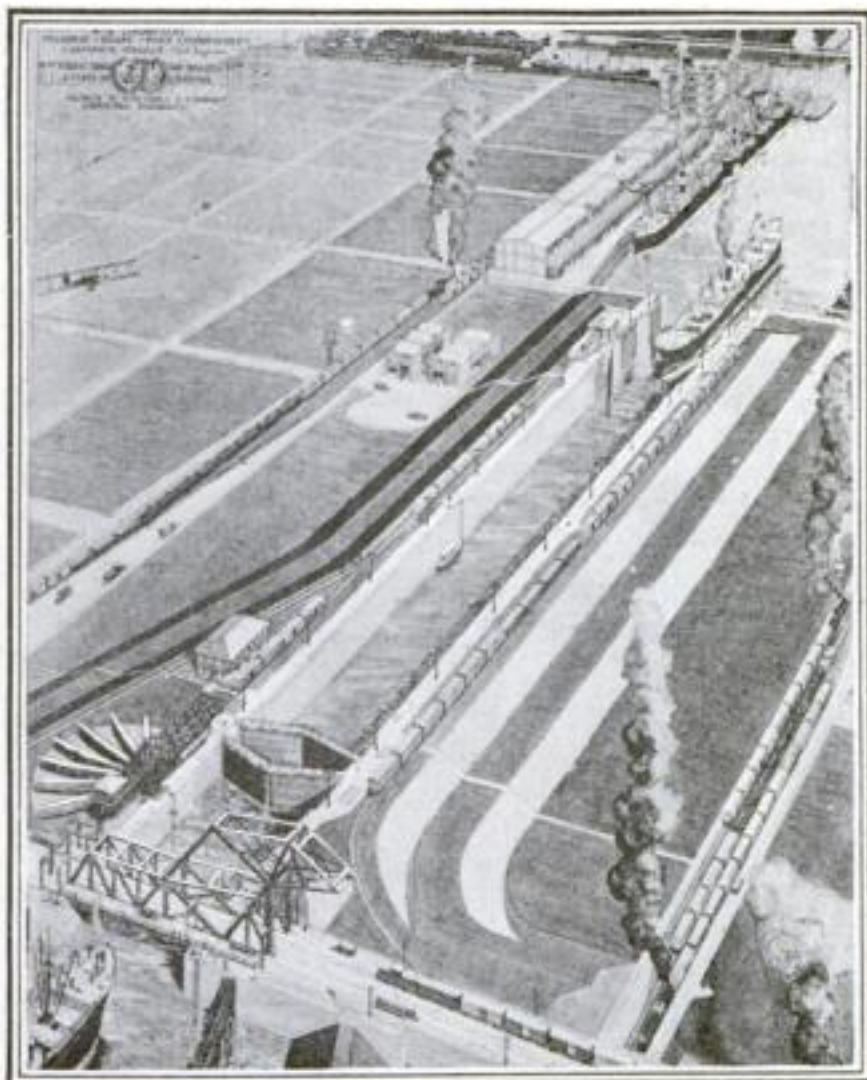
of the siphon—a concrete channel designed to carry the drainage canal beneath the ship-canal, and deliver it to the pumping station on the other side.

The siphon is 378 feet long; it is divided into four compartments: two storm-chambers measuring 10 by 13 feet each; one normal weather chamber measuring 4 by 10 feet; and a public utilities duct. The latter will house the water and gas mains, electric light cables, and telephone and telegraph wires. The storm-chambers handle the rainfall of cloudbursts. In ordinary weather the drainage is concentrated through the smaller chamber, and with the strong flow thus obtained the settling of sediment is reduced. The siphon has a capacity of 2,000 cubic feet of water a second.

There are eight sluice-gates, operated by hydraulic cylinders, to open and close the water-chambers. There are eight manholes, measuring 4 by 6 to 6 by 13 feet, to facilitate repairs.

It took eighteen months to build the siphon. The work presented many difficulties. First the Florida drainage canal had to be closed with two cofferdams. Inside them, the siphon construction began. There was much quicksand trouble. Pumps had to be operated continuously to keep the cut drained. At 46 feet below the ground-level, the foundation piles, from 30 to 60 feet in length and from 3 to 5 feet apart on centers, were driven.

The excavation, foundation, and other work of preparation for the siphon cost more than \$400,000. The concrete cost \$170,000. Machinery and incidentals cost \$60,000.



The largest siphon in the United States. The entire drainage of New Orleans is carried under the ship-canal. The cost of the siphon was \$630,000; its capacity is 2,000 cubic feet of water a second

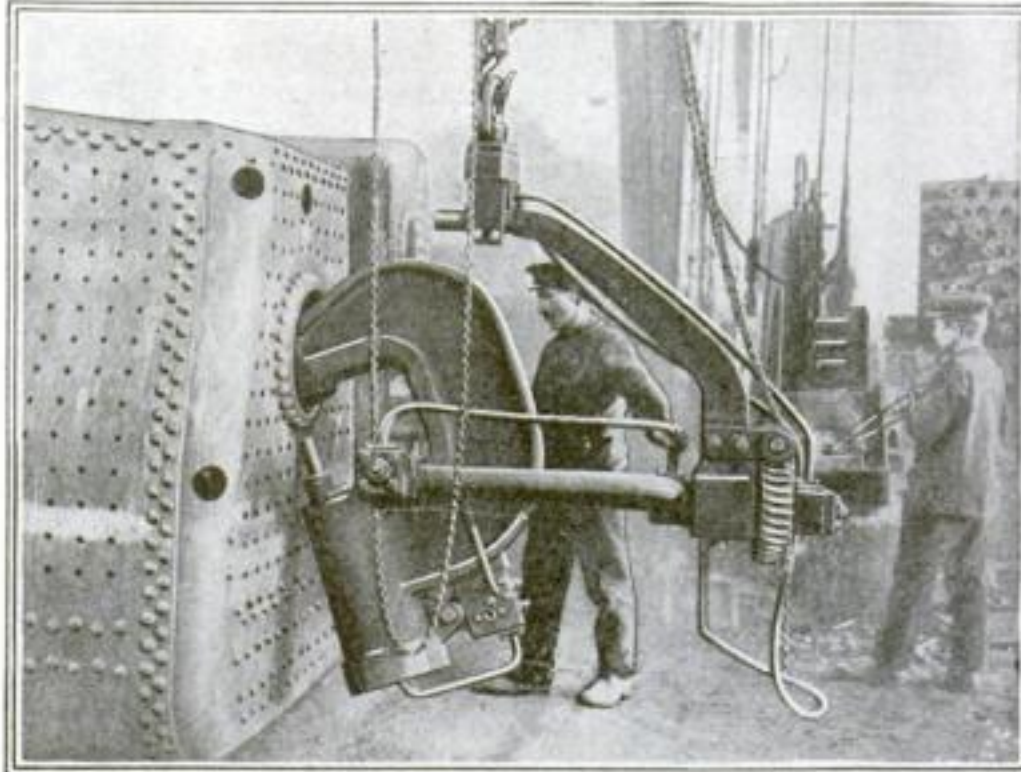


# A Giant with the Touch of a Child

When it is properly guided and controlled, this machine is a magic worker

**C**AN you imagine a giant with hands so strong that he can put a head on a big rivet with a pressure of about 575,000 pounds to the square inch, and yet so gentle that he can crack the shell of an egg without crushing it? The machine shown in the accompanying illustration is just such a wonderful giant.

Look at the powerful pressure clamp, crooked like the monstrous hand of a giant, one end representing the fingers, the other the thumb. By hydraulic pressure this thumb—or, rather, the piston movable in the direction in which the thumb points—may be extended toward the tips of the giant fingers with scarcely an effort. So gentle and delicately progressive is this motion that you may even bend the shell of an egg in the giant's grasp without cracking the



This machine, controlled by one workman, will noiselessly head rivets with a pressure of 575,000 pounds to the square inch

brittle shell, if you stop the motion of the piston in time.

But let the motion of the piston continue, and mercilessly and with irresistible force it will crush everything

that comes between the relentless grasp of the giant hand. A white-hot iron rivet is placed between the extensible thumb and the fingertips of the giant, and in a few minutes the heated end is mushroomed and squeezed into the shape of a rivet head, all without noise or apparent effort.

The illustration shows how this giant hand, properly guided and controlled, is utilized in the metal industry for performing the most difficult tasks, requiring enormous power. The riveting-machine is suspended by chains from a traveling crane, and is placed in working position by an ingenious, yet simple, controlling mechanism. The distance between the working ends of the clamp is one foot, and the movable piston can be extended to a distance of about four inches.

## Taking the Sting Out of the Bullet

**N**OW that the war is ended, what is to be done with the enormous quantities of unused ammunition left over in the military storehouses of every belligerent nation? This ammunition, useless in time of peace, represents an enormous value in copper, brass, lead, and steel, of which the shells, bullets, and caps of cartridges are made.

In Germany, which is in great need of copper, brass, and lead,—more so than any of the Allied nations,—a successful beginning has been made in reclaiming the metals contained in the left-over ammunition. The pic-

tures below illustrate the method employed for reclaiming the metals contained in infantry ammunition at one of the German plants.

A conveyor carries the loose cartridges, as they are taken from their packing-boxes, to an inclined, rotating iron cylinder heated by coke and oil to a sufficiently high temperature to cause the cartridges to explode while they are sliding down the cylinder. The discharged cartridge-shells then drop into a reservoir filled with water. From this tank the cartridges are carried by an elevator to a magnetic separator, which removes all iron or steel particles from the mass.

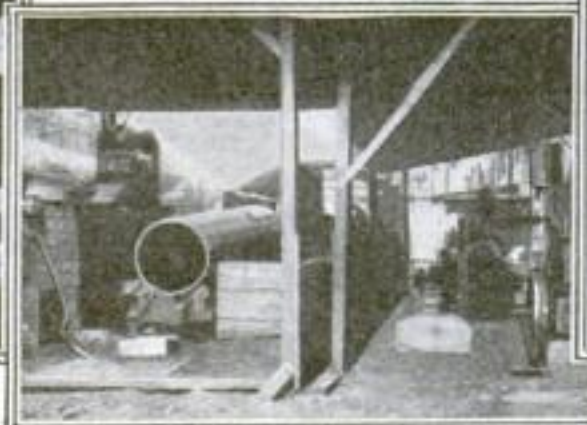
In a perforated rotating drum, heated to red heat,

the lead is smelted out. It drops through the perforations of the rotating cylinder and is collected in molds, leaving only the copper or brass shells and caps in the cylinder. The machinery of the entire plant is operated by a five-horsepower gas-engine and disposes daily of about 1,000,000 cartridges.

By this method of reclaiming the metals contained in ammunition, nothing is wasted but the powder charge and the small quantity of fulminate in the ignition-caps. To extract the charges of smokeless powder would cost more than the powder is worth.



The heat of the rotating cylinder through which they slide causes the powder of the charge to explode

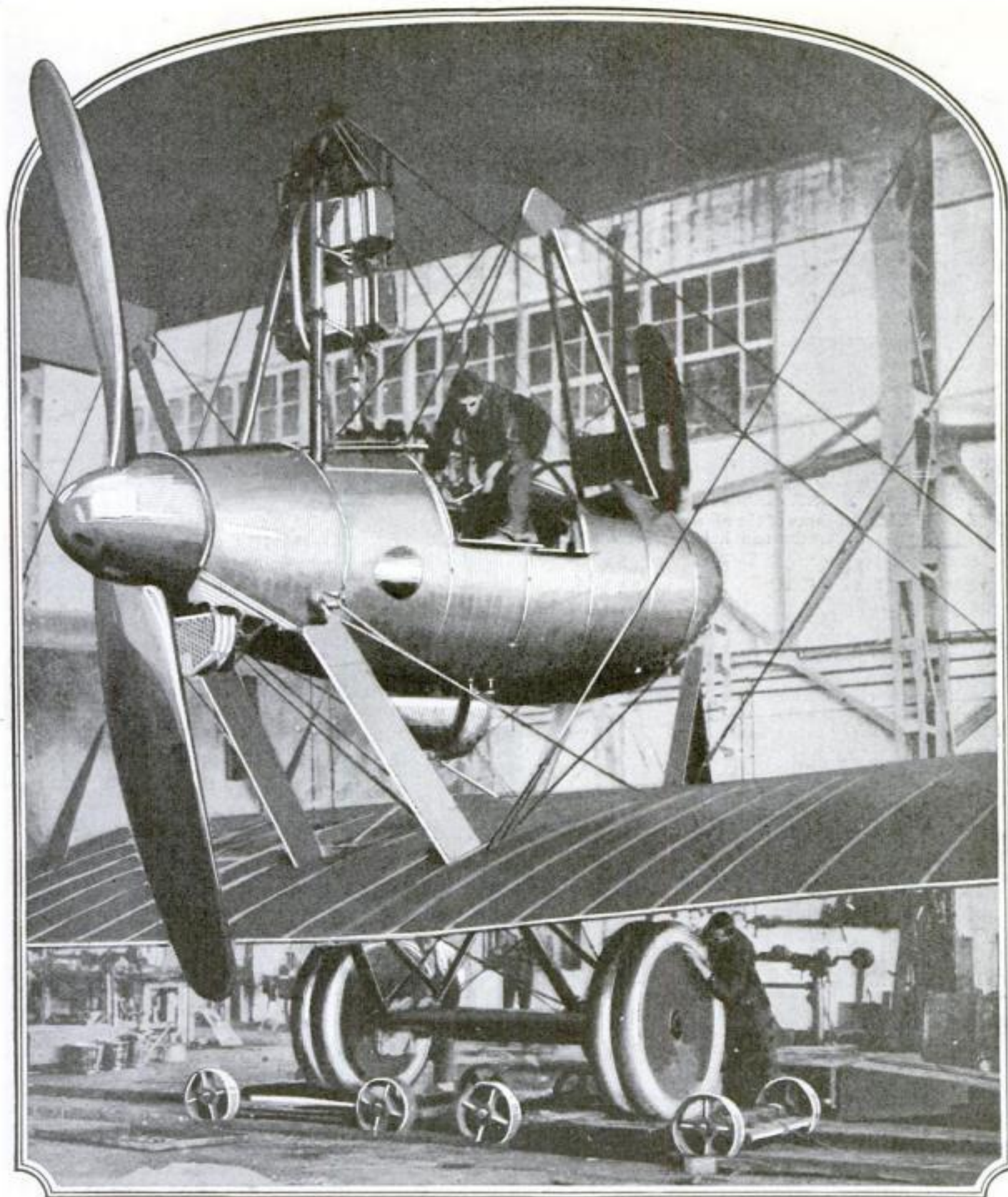


In this heated and rotating drum the metals are separated by melting out the lead of the bullets



The cartridges are unpacked and placed on the conveyor which takes them to the discharge drum





## A New Giant of the Air

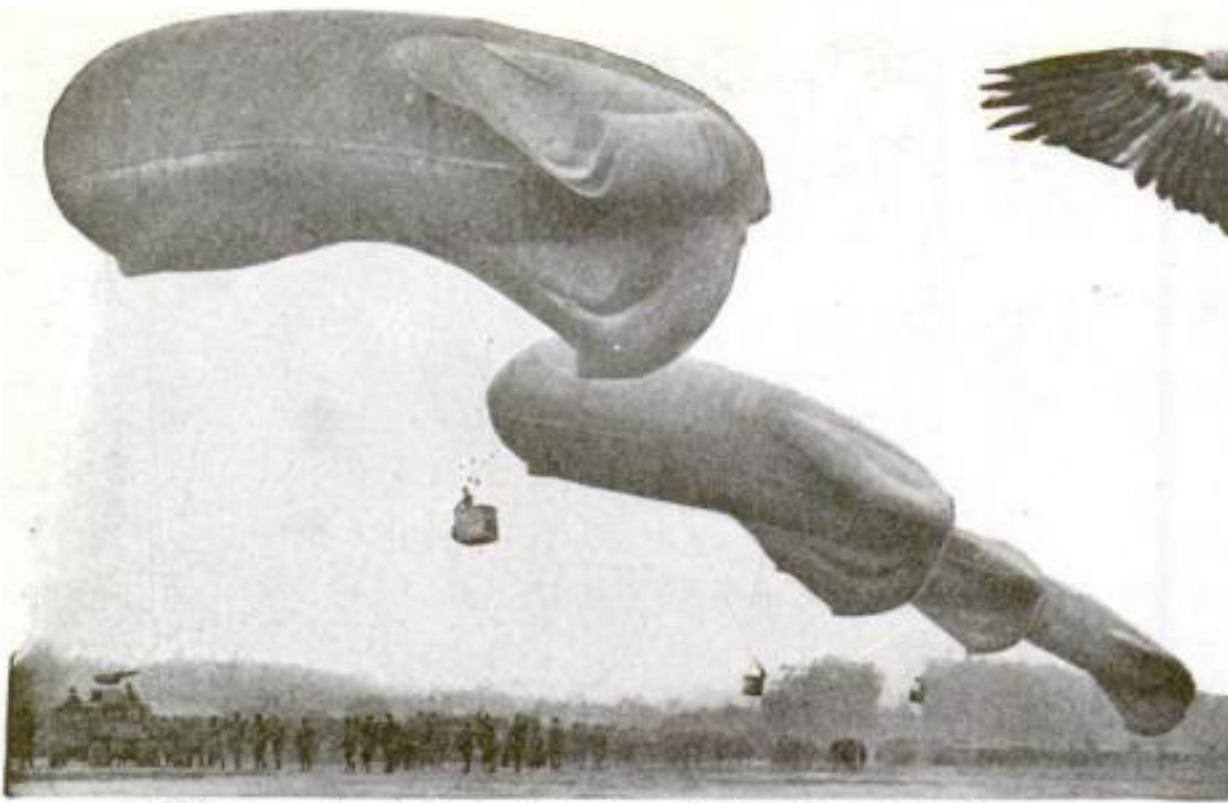
**W**HAT will be the size of the largest airplane that we can ever hope to build? What are the elements that limit the flight of heavier-than-air craft? The forces that operate upon the airplane in flight are dependent upon the size of the machine, its shape, the density and resistance of the air, and the wind-pressure.

The first airplanes were almost mere box-kites with the pilot exposed to the full force of the wind and his body offering resistance to the motion of the craft through the air. Imagine an attempt at speed on water when one's boat is a square box that has projections sticking out from it offering resistance to the medium in which it moves. What would happen if a powerfully equipped engine were placed on such a boat to try to drive it at motor-boat speed? The force of the engine would probably smash the craft on which it had been placed if this craft were of such frail construction, comparatively speaking, as were the early types of airplane.

Following the hint given by the shape of certain birds and fish whose motion in air or water is smooth and swift, modern airplanes are constructed with serious regard to their stream-lines. The flow of the air around them must be smooth and uninterrupted by awkward projections.

In the new giant Aviatik airplane recently given satisfactory tests in flight carrying twenty-two passengers with baggage, there are two advanced motors of 220 horsepower to pull the craft through the air, and two additional 500-horsepower engines in the rear to push. A "gondola" carrying one of these 500-horsepower engines is shown in the picture. Note also the huge wheels of the landing-gear. Great tanks carry almost 2,000 gallons of fuel. The greatest attention is given to the stream-line construction, thus reducing the resistance offered to the air by the exposed parts of the framework. With a wing span of about 400 feet the Aviatik airplane is the largest in the world.





These monster elephants of the air are lined up for parade; they are kept in place by trucks and hundreds of soldiers holding ropes

## Elephants on Parade

**Y**OU may think you have seen enough parades in the past year or so to last you a lifetime.

Ah, but when the elephants of the air parade, you get an entirely new set of thrills! The picture above shows one section of an "elephant" parade that took place recently at Arcadia, Cal. The monster gas-bags were lined up side by side and held in place by individual motor-trucks on the ground and by hundreds of soldiers holding ropes.

When the parade began, the trucks moved forward slowly; so did the soldiers. The elephants moved with them, and the crowds near by enjoyed the spectacle.

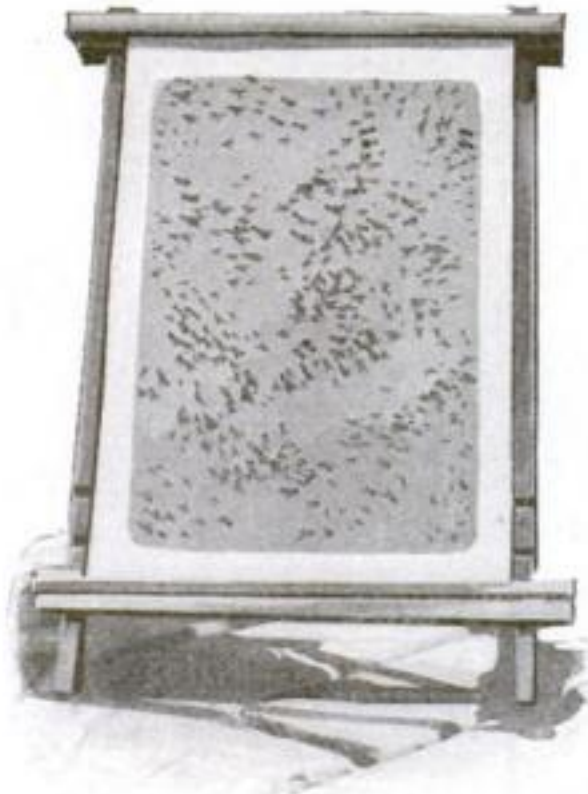
## A Snake Memento

**T**HE snake cherishes its rattle and adds a new section to it each year. It carries its rattle high in the air to protect it from harm. But when there are ten sections to its rattle, the outside section usually wears off. Thus few snakes are found that have rattles of more than ten sections.

A man in western Kansas kept the rattles of all the snakes he killed and mounted them on a card in star formation.



These are the rattles from the various rattlesnakes that one brave Westerner killed; rattlers add one section a year to their rattles



A holder for preventing the fly-paper from being blown about by the wind and doing damage

## Making the Fly-Paper Stick to Business

**A** NEW JERSEY man has invented a device to keep fly-paper in one position and from being blown by the wind on to Father's favorite chair or Mother's most treasured lace curtains. It consists of a frame having grooves at each end to permit the insertion of the sheet of fly-paper. A narrow strip of wood is forced down into the groove over the paper to hold it taut. At the lower end of the frame three grooves are located for taking care of any variations in the lengths of the fly-paper.

When the fly-paper is in its frame, it may be placed up in any convenient place, and will be so conspicuous as to be readily seen before being sat upon. In addition to being useful as a holder for fly-paper, the device can be used as an embroidery-frame or as a stretcher for cloth or paper.



An eagle shot in Alaska. It measured seven feet nine inches from tip to tip. Hundreds of these monarchs of the air can be seen in the course of a journey along the shores of the icy fjords of Alaska

## A Feathered Robber Baron of the Air

**T**HIS feathered monarch of the great Alaskan forests was shot near Wrangel, and measured from the tip of one wing to the tip of the other seven feet nine inches. It is not unusual, when sailing among the fjords of Alaska, to see hundreds of these winged autocrats consorting, in really frivolous moods, among the debris along the shore, or screeching among the great forest giants that hold their nests.

The eagle has ever been a symbol of power, imperious arrogance, and despotism. It is the last emblem, from that viewpoint, that should represent the ideals of democracy, under a republican form of government. But the eagle inspires also the idea of freedom, and of that it is a fitting emblem.

## The Eel and the Tortoise

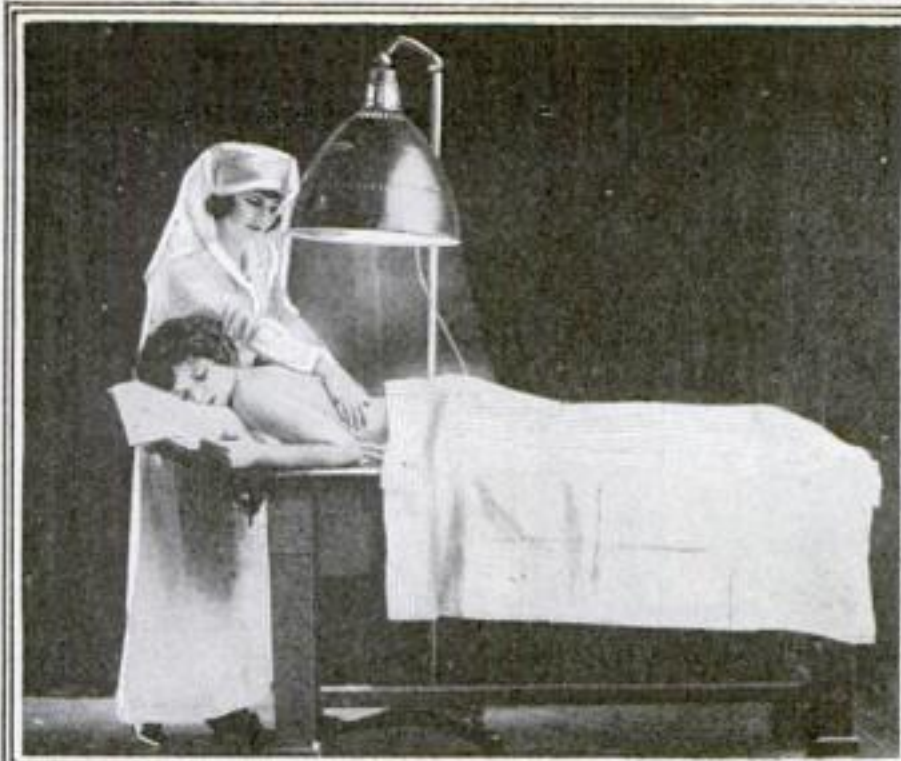
**Y**OU know the tale of the hare and the tortoise. Now hearken to the tale of the eel and the tortoise. Both of them were taking life easy hundreds of years ago, when a sudden flood, carrying wood, mud, and stones with it, overwhelmed them. The eel was wrapped around the turtle's legs when they were trying to find shelter, and both of them were killed.

How do we know this story? Because their bodies became fossilized, and were recently found in one of the many fossil-beds of Oklahoma.



The eel and the tortoise died together hundreds of years ago, presumably in a devastating flood; their bodies were turned to stone





The rays from a powerful light inside this reflector penetrate the patient's skin and stimulate the blood-cells

## Fighting Disease with Light Rays

**H** EAT and light, it has been found, will help cure many ills. They stimulate both the red and the white blood-cells, causing the cells to put up an active fight against disease germs. In many hospitals powerful electric lamps are placed inside reflectors and the piercing rays are used for treating Bright's disease, rheumatism, influenza, and pneumonia.

Pneumonia, especially, is a disease that a patient must fight by himself. And the condition of the blood is a deciding factor. The blood fights the poison, and, if it is in good condition, checks the infection.

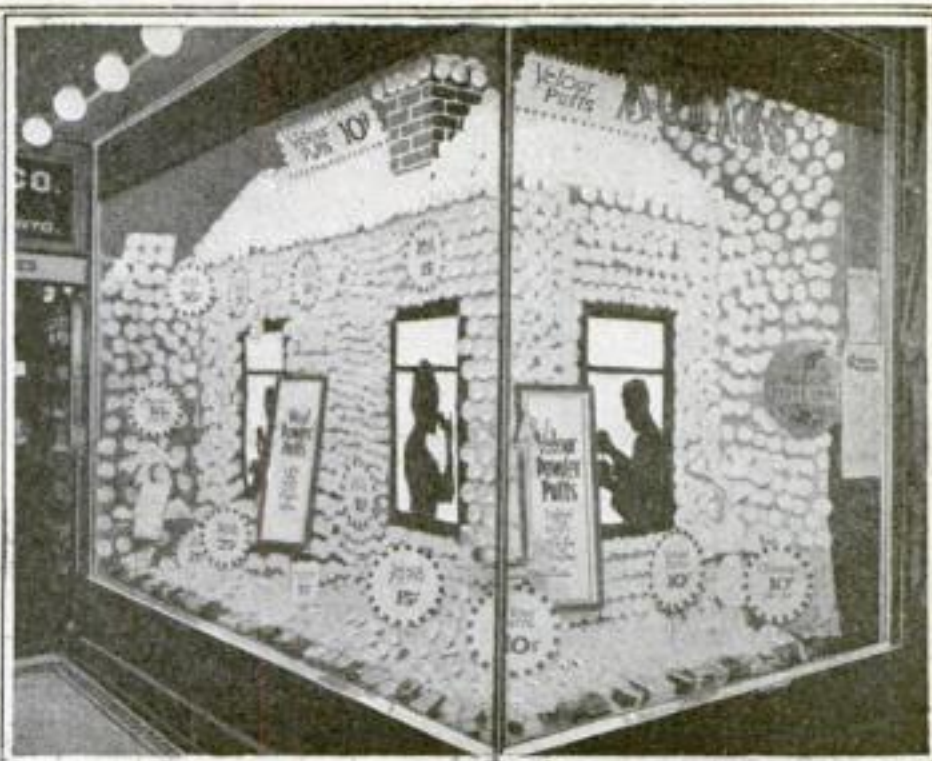
## Fashions in Canes

**F** O R a long time men have sat back and let the women wear all the gaudy clothes and carry the beaded bags and fluffy dogs. But now the men have started. Not long ago we saw for the first time brilliant satin lining peeping out of their new bell-shaped cuffs.

And now men's canes have lost their dignity. Puppies, pussy-cats, and baby bunnies are carved on their knobs. And the dear creatures sit up and beg in the most touching manner.



Puppies, pussy-cats, and bunnies carved on the knobs of canes. Are men too having fads now?



It snowed powder-puffs in this drug-store window: there are large ones, small ones, cheap ones, dear ones

## The House Built of Powder-Puffs

**N** O home is complete without a powder-puff, but there is such a thing as too many powder-puffs. Here is a house that is literally covered with them—ten-cent puffs, fifteen-cent ones, quarter ones, and even thirty-five-cent ones hanging all over the walls. Some of them are wool puffs, others velour.

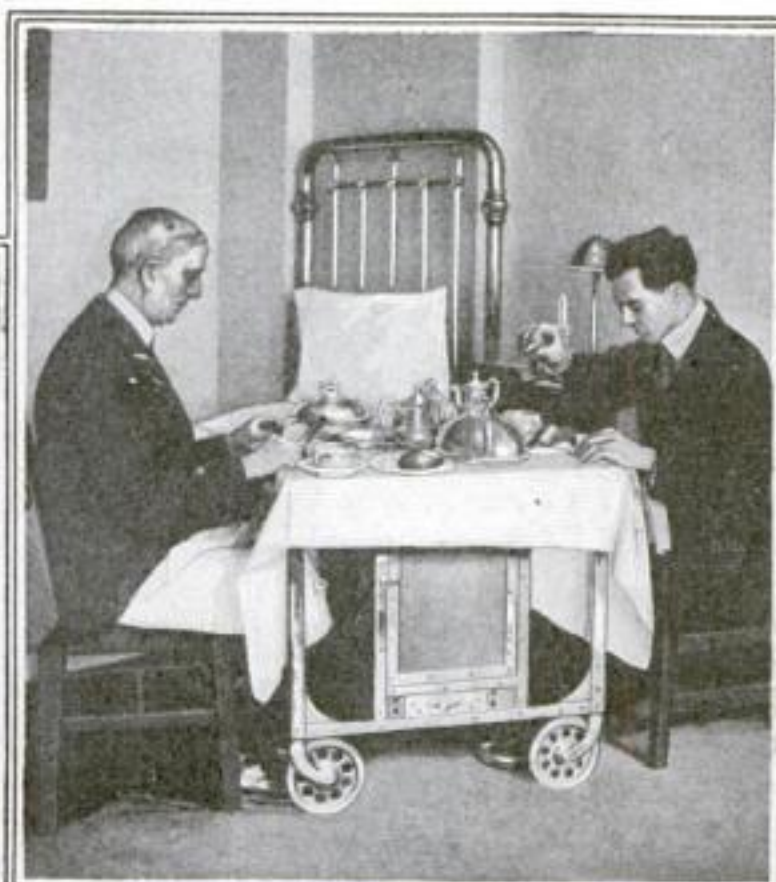
What's the idea? Advertisement. The druggist in whose show-window the puffy house was built had so many powder-puffs he didn't know what to do—until the idea of the puff house struck him.

## Stockings Come High!

**L** O O K out when you buy silk stockings and be sure you ask the price first. If not you may sustain an almost total loss of one hundred dollars.

That's what they are charging for stockings in some shops on Broadway, New York. True, one hundred dollars doesn't buy much these days; but at least you can get three tires for your Ford for that amount, or buy your old shoes enough inner tubes to last for five years.

© Kadel & Herbert



The waiter wheels your breakfast in and departs. The top of the table is set and the food is in the oven beneath, where it is kept hot by a brick



The cost of high living has a striking illustration in this hundred-dollar pair of stockings



Place the work on the table, turn the table to a convenient position, lock it, and proceed with the work



### Turn the Table and Lock It

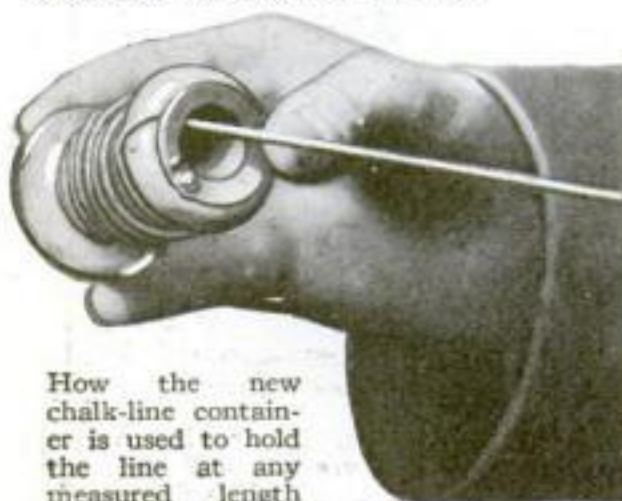
A WORK-TABLE that locks in thirty-six different positions, and which rotates on ball bearings, is indeed a serviceable accessory in the machine-shop. Any work that one may be engaged in, whether it be welding or merely the assembling of small parts, can be handled efficiently with this table.

Instead of having to move the heavy object that is being manipulated on the table, to place it in convenient positions, it is secured to the table and the table turned on the ball bearings to the desired position, and locked. The locking device may be managed by a foot-pedal on the floor attached to the upright support of the table. For welding, the table is a valuable time-saver.

### The Line Doesn't Tangle in This Container

"WHAT a tangle!" And the carpenter reaches into his tool-box to untangle the chalk-line from his tools.

That was the old way. The new way is to use the clever chalk-line container invented by Mr. Frank G. Pierce and Mr. Charles M. Propst, of Marshalltown, Iowa. It consists of a spool and a metal strip at the end of the spool under which the chalk-line is slid when it is desired to measure off a length of the line.



How the new chalk-line container is used to hold the line at any measured length



A smaller table, which is made to rest upon the work-bench, also locks



It may be made into a paper-hanger's bench or a painter's scaffold

A painter's trestle that can be easily folded into a small compass for carrying from place to place



### A Folding Trestle for the House-Painter

A NEAT bundle of boards, then, presto! it is changed into a table or a platform, a trestle or a painter's swing bridge or scaffold.

The patent granted to Mr. Alvin Leonard, of Carbondale, Pa., introduces an interesting device serviceable to paper-hangers, painters, and carpenters. It is literally a collapsible trestle which may be folded into a compact bundle easily carried. Mr. Leonard made it because he found that he needed something more convenient to carry than a step-ladder and planks for a painter's trestle.

He used it in his work as painter and paper-hanger; his fellow workers discovered that it would serve for anything, from a table or a bench, to a "swing bridge."

### The Importance of Railroad Tie Spikes

WHEN the train runs smoothly along the rails no one thinks about the track and how important are such details as the spikes that hold the rails to the ties.

Walk casually along a seldom used railroad switching branch. Look down at the rotting ties and see how the spikes seem to be so loosely embedded in the wood that one could almost pull them out by hand. Why is the holding power of the spikes so impaired? The Civil Engineering Testing Laboratories of Columbia University, New York city, can answer the question, because a thorough test of the holding power of railroad spikes has been made there.

When a spike is driven into a tie, the wood is forced downward and the fibers are pressed outward. A new type of spike has been devised which bores its way into the wood as it is driven in. The holding power of spikes is determined by the amount of surface in contact with the wood and by the condition of the wood fibers. The new spike has 25 per cent greater surface area than the old spike, and it is fluted so that it compresses rather than crushes the wood fibers.

### Two Eggs that Grew as One

EGGS of the kind shown below are not of unusual occurrence, according to poultry experts. Various kinds of freak eggs, sometimes one egg within another, sometimes two yolks, sometimes two eggs attached end to end, are reported.

Some disorder in the egg-making process is held responsible. For example, the shell-making substance begins to do its work while another yolk is forming.



An egg that has one shell inside the other. Such freaks are due to a disorder in the egg-making process within the hen



## Rewards for Cleanliness Bring Quick Results



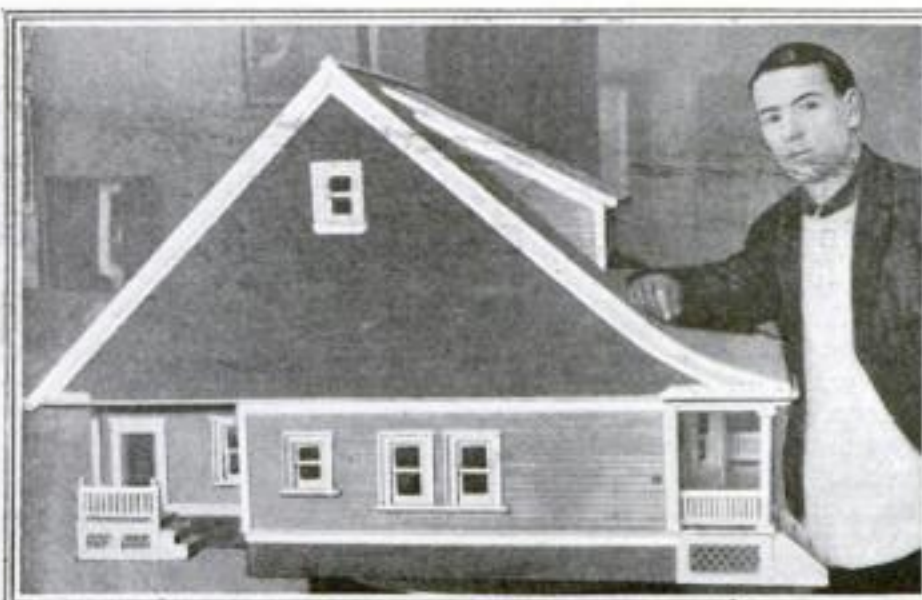
A tannery that offers prizes for cleanliness. On the blackboard the winners are recorded regularly.

"WELL! Here's a chance to win a prize," the workers in a big plant reflected a dozen times each day. As they thought about it, they set to work cleaning up their department.

Posted on a blackboard in a large tannery is a list of the winners of prizes for cleanliness in the various departments. The idea of rewarding workers for keeping their departments in extra-fine order proved entirely satisfactory, and resulted in a tannery that is ready to bear scrutiny all the time.

## A Doll's House Equipped for the Queen of Dolls

FOR five years Albert Langley of Cambridge, Mass., has worked on the doll's house shown in the picture. It is complete to the minutest detail. All the rooms are papered, varnished, and equipped with electric lights. A parlor, dining-room, kitchen, pantry, laundry, and reception-hall occupy the first floor; bedrooms and bath, the second. There are shades and curtains to all the windows.



Five years of spare moments were needed for building this minutely perfect doll's house. Every room is completely equipped.



A flytrap useful where flies gather in numbers. An electrically driven fan sucks them in.

## Fanning Flies to Destruction in an Ingenious Trap

"THE air smells good around here," says Mr. Fly as he begins to circle around the entrance to a remarkable fly-trap invented by Mr. Harry Pakeman, of Columbus, Ohio. The fact that the air near the trap is permeated with the odor of the bait is the curious result of an early experiment of the inventor. He made a trap which consisted of a fan, rotated by a motor and producing suction strong enough to draw the flies into a net bag at the back of the trap. This resulted in a fairly good catch of flies. But after the first victims were safe in the trap the other flies in the room gathered around the net bag, apparently much interested in the fate of their brothers. They were thus at the wrong end of the trap to be caught.

The real reason for this conduct on the part of the flies was not curiosity. It was the enticing odor of the bait blown out into the air through the net bag. This gave the inventor a tip, and in his improved flytrap he has arranged the rotating fan so that the suction compartment or entrance to the trap is just above the bag of victims. Now the inquisitive flies that come make a long stay.

## Shoe-Shines Free! How One Cobbler Attracts Patrons



One shoe-repair man has drawn trade by a free shoe-shining device before his shop.

STEP up to the front of a shoe-repair shop and get a free shine. Into a little window at the bottom of the counter the dusty shoes are placed, and the brushes quickly do their best to "shine them up."

While the revolving shoe-brush is polishing your shoes it inspires a warm feeling for the enterprising repair-man who installed it, and if you need to have any repairing done, you conclude that he is just the man to do it. Hundreds of people come every day to the shop, and are held by this artful device.

## Argentina That's the Place to Travel In

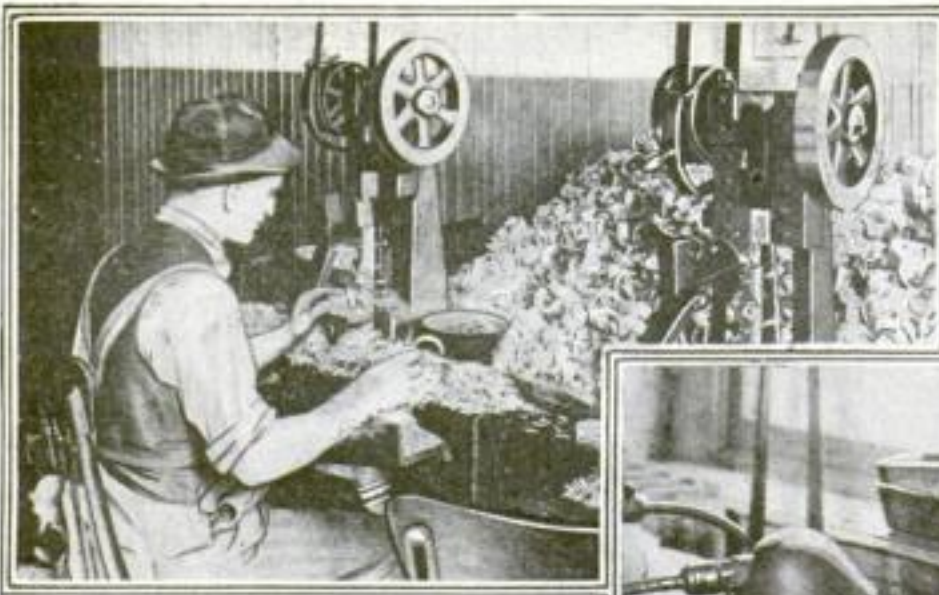
IF, instead of returning all the railroads to their original owners, the government had handed them over to the Argentine Railroad Company, how happy we would be! This Argentine company gives its passengers real food to eat and real drinks to drink. What is more, there is a piano at the end of each dining-car. Music, wine, good food—what could mortal wish for more?



There is a piano in each dining-car on the Argentine Railroad. Music and wine with your meals.



## Making Bamboo Needles for Talking-Machines



The sections of bamboo are split at the rate of 10,000 needles an hour

This machine finishes the split bamboo strips and makes them ready for the process of pointing by hand



**C**URIOS, isn't it, that the soft, sweet sounds of Galli-Curci's voice can come to the ear through the fibers of a bamboo phonograph-needle! These needles are made by machinery.

The tall canes from the bamboo thicket are cut into sections and selected carefully before being sent to the factory to be made into needles. Attention is given to keeping the enameled outside surface of the bamboo intact to make the hardened point of the needle. By machine the sections of bamboo are split into 10,000 needles an hour. Then each needle is pointed by hand. The prism-shaped pieces are inserted in a triangular bushing on a cutting-machine and a perfect point is obtained by running out to the cortex side of the bamboo. These machines turn out thirty thousand needles a day.

## Listen to the Sea-Shell on Your Phonograph

**A** NOVEL way of listening to the music or spoken words of a phonograph has been developed with the aid of a conch-shell. The large open end of the shell serves as a projector of the sound-waves—here waves of music instead of the waves of the sea. The small end of the shell is attached to the phonograph. It may be attached as a horn would be, on the outside of the mechanism, or it may be placed within the body of the cabinet to project the sound through the usual outlet.

When one holds a conch-shell to his ear, what does he hear? The familiar saying is that he listens to the waves of the sea rolling and breaking upon the glistening beach; and it is true that the sound calls up before his mind's eye some such picture, the more vividly that he knows the source whence the shell has come. But in reality he hears only the faint outside sounds that are caught by the peculiar shape of the shell sounding-board and concentrated in his ear. This device of Nature for gathering the sound combines satisfactorily with the vibrating apparatus of the talking-machine. The sound-board of the shell catches the vibrations and faithfully reproduces them. The phonograph in the picture looks odd at first sight, but after all the conch-shell was an ornament in good standing with our grand-mother.

The shell attached to a phonograph projects the sound, concentrating the vibrations. Placed within the cabinet of a phonograph, it works as well



## How Money Can Be Made From the Scrap-Pile

**T**HERE is a scrap-pile in every shipyard and in the vicinity of structural steel plants, from which rivets and bolts in great numbers can be salvaged. Two machines have been invented to do this economically. Above one of them a revolving tray is placed, provided with slots to accommodate bolts of certain sizes and of any length. Two operators place the bolts in the slots as the tray slowly revolves. As each rivet or bolt reaches the device set for its length, it is tripped or dropped through a chute to its keg. Thus, simply and faultlessly, are the bolts and rivets assorted for length.

Under the old method men had to measure the bolts by hand, and at best could assort only about 12 kegs in a 12-hour day. Two men can do this by machine at the rate of 7,500 rivets an hour, or about 100 kegs a day, with a saving of \$6.34 a ton.

In a power-driven assembling machine the bolts are threaded quickly. When a bolt is placed in position, a slight pressure of the workman's foot on a lever, imparts a forward or a reverse motion as desired. Of the bolts and rivets in the scrap-pile 90 per cent. need only a cleaning up of the burred threads, and this is accomplished by the machine satisfactorily, reducing by 85 per cent. the power required under other methods with a total saving of \$6.73.

He gets all the benefits of running, without moving forward



## Even Your Running You Can Now Do by Machinery

**R**UNNING is very good for the health, but in these days of crowded cities a man can't run very far without having a policeman run after him and grab him by the shoulder: it looks suspicious.

You can have your daily run, however, if you get one of the new running-machines shown here. Instead of moving forward at each step you take, you remain in the same spot. The pathway slides backward on steel tracks located at the ends of the running-machine. The man who is shown in the picture using the machine is Jack Cooper, a well known trainer.



## More Speed from the Pedals of Your Bicycle if You Use this Weird Model

WITH its frame extended in the rear, supporting a sprocket-wheel that is connected by a chain to a smaller geared wheel, a new type of bicycle makes its appearance.

The pedals are attached to two levers. These are pivoted to the frame, and as the bicycle is propelled, they work criss-cross, somewhat like a pair of huge scissors. A stout steel pin secured to the sprocket-wheel works backward and forward in a slot in each lever, as the pedals at the other end of the levers are worked up and down. This motion revolves the sprocket-wheel, operates the chain, and turns the rear wheel.

The bicycle rider has the satisfaction of keeping the dirty grease of the chain and sprocket-wheel far in the rear. The device provides different speeds, and can be adapted to drive other mechanisms than that of a bicycle.

A new arrangement for driving a bicycle, having the transmission-gear placed behind the rear wheel. This patented device can be arranged to furnish different speeds



## Use Your Canoe for an Umbrella When It Rains

THE watertight hull of the canoe can be used to advantage on dry land as well as in the water and it acts as efficiently in keeping out water from above as from below. When dusk approaches and the sky lets out raindrops instead of stars, the canoeist can lift his craft out of the water and make use of it as a tent. Canvas, cot and supporting poles are folded and tucked into the bottom of the canoe. Held in place by a pair of bars pivotally connected, are the supports that can readily be taken out and set up to carry the canoe. The bottom of the frail craft becomes the main support for the canvas of the tent. The canvas is thrown over the hull and staked down, or it can merely be thrown over one side, forming a "lean-to"

To afford shelter for a folding cot the canoe is turned upside down, and one end of it is raised from the ground until it rests upon the supporting-standards. A cross-bar connects the standards at a suitable height. The canoe-tent is the invention of Mr. Ralph Douglass George, of Kansas City, and to him the belated canoeist will return fervent thanks when a shower comes up, if he has been wise enough to provide himself with the apparatus described. It adds very little to the weight of a canoe.



A rubber ball around the hen's leg takes her mind off the subject of setting

## To Keep the Hens from Setting at the Wrong Time

A DEVICE to prevent hens from setting when they should devote themselves to laying, has been invented by John J. Gottschalk, of Taunton, Mass. It consists of a hollow rubber ball with opposite star-shaped openings to allow the passage of the hen's leg through the ball. The rubber will engage on opposite sides of the joint of one leg, and make any attempt at setting a thoroughly one-sided affair. The device, being of rubber and resilient, is not sufficiently rigid to be likely to injure the hen in any way, even though it effectually prevents the bending of her leg.

One cannot but speculate upon the thoughts of the lady fowl who is thus handicapped from carrying out her heart's desire. It is rather rough on her, we frankly admit, and her reflections can scarcely be complimentary to man, but since the invention works to the good of humanity, the poor creature's personal preferences must needs be disregarded.

## A Free Home With a Barbed-Wire Fence for the Owl

IN Arizona and New Mexico, where the giant cactus rises from 15 to 20 ft. above the landscape, the elf owl is found. This little bird is the "vest-pocket edition" of the owl family and is hardly larger than a sparrow, being only from 5 to 6 in. long. Its color is gray or brown and its specialty consists in making its home in abandoned woodpecker-holes in the giant cactus.

The owl roosts in these holes throughout the year. During the egg-laying season, the mother bird deposits her eggs in the holes without going to the trouble of making a nest. Since the woodpecker-holes are usually well up on the trunk, little danger can come from below, and the stiff spines act as an additional guard against intruders. Should the woodpeckers return to their old homes there might be trouble, but they never do.

The food of this inconspicuous little desert-dweller consists of grasshoppers and bugs—a very modest diet. Interesting as the bird is, because of its shyness and its small size, only a few persons have ever seen it or know of its existence.



The abandoned woodpecker holes in a tall cactus are just what the elf owl wants for a nest



Here is a canoe that carries along its tent-poles and itself becomes the chief support for the canvas



## Counting Miles on a Typewriter

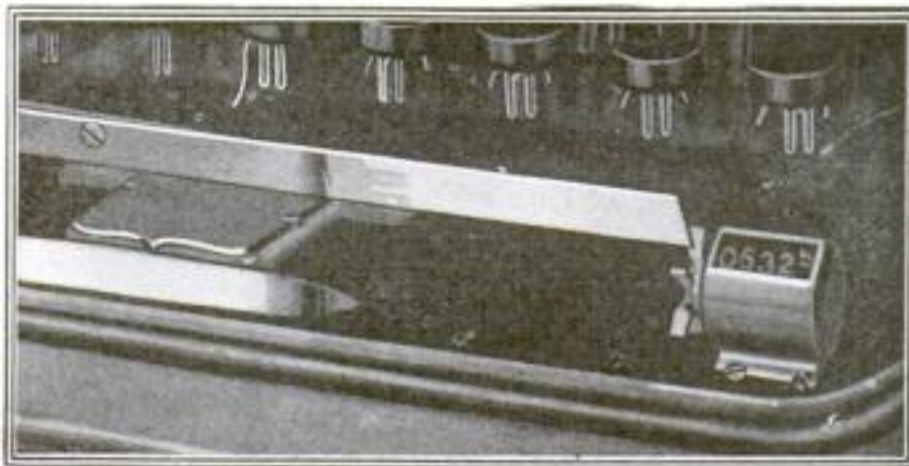
**A**TTACH a cyclometer to your typewriter. The arrangement is merely an adaptation of an ordinary cyclometer. It counts words by the mile.

A metal bar can be soldered to the space-bar of one's typewriter and fixed so that it extends far enough to engage the cog-wheel of the cyclometer. Allowing one touch of the space-bar as a true division between words, it takes just so many depressions of the bar to cause the cog to make one revolution. The cyclometer is firmly fixed to the same base as that which supports the

typewriter, and it registers one column in tenths of miles. Counting the number of words necessary to make a tenth of a mile and calculating ahead, it is found that there are 750 words in every mile.

A space must be made at the end of each line or allowance should be made and the number of lines counted as words, and added to the registered number. A cog-wheel can be soldered to any form of rotary counter, if one needs his cyclometer on the bicycle or the automobile, and if the spacing between words is truly recorded, the number of words can be quickly read.

Authors who measure their output in thousands of words may figure instead how



A clever adaptation of a cyclometer attached to the extended space-bar of a typewriter measures words by the mile and suggests long-distance typing races

many miles they accomplish each year. Reckoning twenty-five words to a foot, the author may refer to a new one-mile novel he is contemplating, while he dashes off a little story less than  $\frac{1}{8}$  mile long, and a yard or two of verse. The device also opens possibilities of typewriting races by the mile.



An Indiana farmer giving his wheat a bath. The seeds are placed in a cylindrical tank which revolves in a wooden tub filled with hot water

**I**F wheat seeds are given a hot, steaming bath before they are sown, they will grow into healthier stalks. Smut and similar wheat diseases, which often ruin as much as a quarter of the wheat crop, will be washed away.

Giving wheat seeds their bath, however, has always been a slow process. But Russell East, of Indiana, has recently invented a bathing device that will clean as much as one hundred bushels a day.

The first step is to soak the seeds in cold water for about three hours. Then they are dumped into a cylindrical tank that is covered with wire screening. The next step is to lower the tank into a wooden bath-tub

that is filled with water having a temperature of 120° F. The tank is revolved for a minute and then withdrawn. Steam is forced into the water, pushing the temperature up to 129°. Then the wheat is given a second bath that lasts for ten minutes. When the seeds are removed and dried they will be absolutely pure.

A chain hoist and track take care of the raising and lowering of the cylinder, and the steam is piped from a traction engine.

Smut and other diseases that wheat is heir to, are washed away by this process, and the wheat goes into the ground in a healthy condition, to grow up strong and well, a comfort to the farmer.

## Taking Kinks Out of Street-Car Tracks

**R**AILS that have been used under heavy traffic conditions for some time without having been smoothed by regrounding will make riding in a street-car quite as exciting as will a flat wheel on the car. All rails become rough in spots through the grinding effect of the wheels in starting and stopping the cars, and must be reground at regular intervals to avoid discomfort to trolley patrons and injury to the rolling stock.

Formerly the rails were reground by a

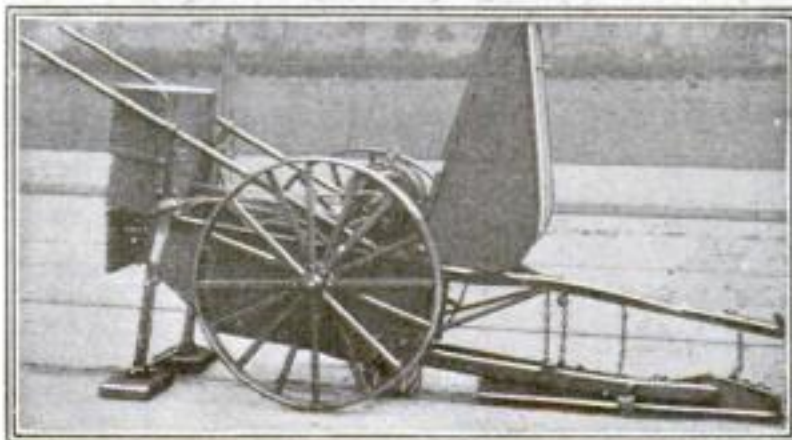
simple grinding tool operated by two men sitting facing each other on low benches over the rail and pushing the grinder back and forth by hand, as shown in one of the accompanying pictures. The other picture illustrates one of the modern electric rail-grinders used with success on many large European street railway systems.

The motor which operates the grinder, and which receives its current from the overhead wires or a storage battery, is enclosed in a hooded box mounted on

wheels. The grinding tools are suspended by chains from a pole at one end of the cart, while the other end is weighted with sandboxes and provided with a rack-and-pinion mechanism by means of which that end may quickly be raised, thus lifting the wheels off the ground. The electric rail-grinder accomplishes work that formerly required the efforts of two men, and does it in less time. Also, this grinder never gets tired of its job and the monotony of removing kinks does not concern it.

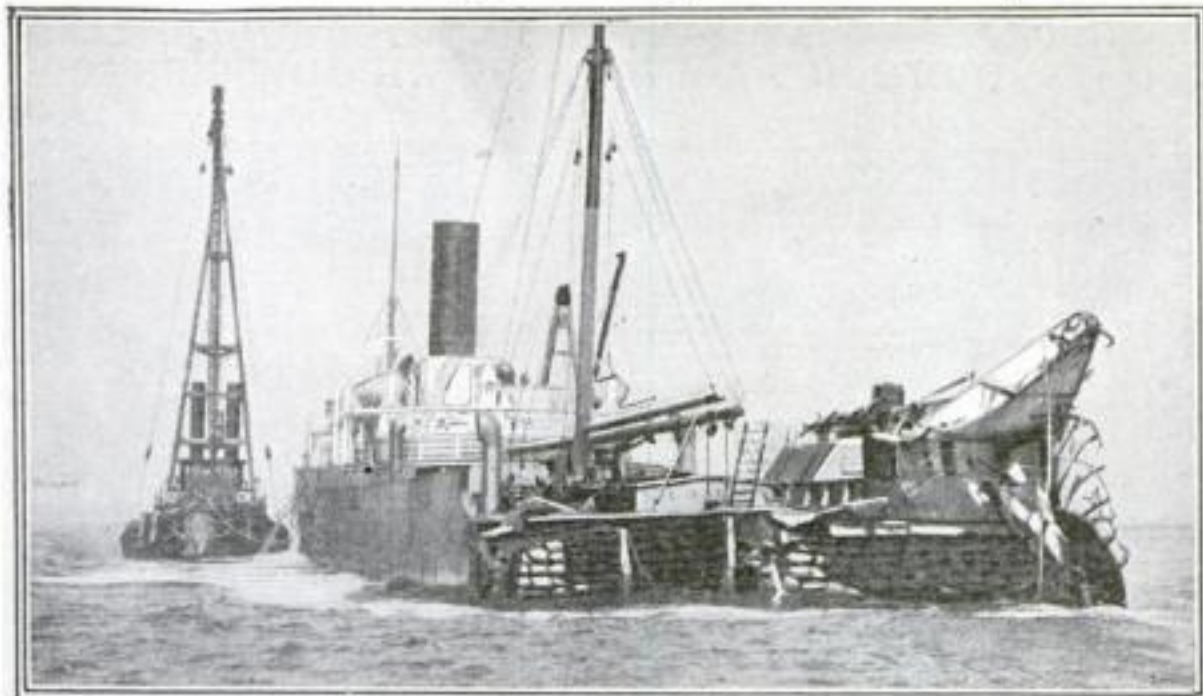


Formerly rails were reground with a hand-operated tool. The modern electrically driven grinder, pictured on the right, does the same amount of work in one fifth of the time





## Cutting through Steel Ship Plates Under Water



The steamship *Lord Dufferin*, after having 65 feet of her stern cut away, was beached off the Statue of Liberty. The under-water arc-cutter was used in salvage operations.

**T**HERE are sunken steel ships not too deeply submerged to be salvaged at a profit. In attempting the task of salvaging, vessels of massive structure must be manipulated in mechanical ways that vary in almost every instance. The methods employed to lift one ship may not be suitable for raising another. But in nearly every case, especially where pumps must be put in below the water and where cutting and welding must be done, the cutting of steel under water is a difficulty. In the past dynamite has occasionally been used but it has always proved ineffective and, destructive.

A useful tool for the salvage crew is a recently patented device which consists of a powerful arc through which flows a current of oxygen, employed for cutting metal plates under water. The electric current

raises the arc to an enormous degree of heat, so great that it will cut through a sheet of steel with the ease of a knife cutting through cardboard. The metal becomes a field of molten craters as the tip of the current-bearing electrode is passed across it. The arc itself is formed in the usual way, and when formed gives off an amount of heat which converts the surrounding water into steam so rapidly that the water is prevented from coming into contact with the arc-crater. Thus the temperature of the metal is not lowered by the water.

The under-water arc-cutter demonstrated its usefulness and value in the work of salvaging the steamship *Lord Dufferin* which was beached off the Statue of Liberty in New York harbor, after having sixty-five feet of her stern cut away. She

was in a sinking condition and partly submerged when the salvage work was undertaken.

The arc-cutter was employed for the submerged sections and was driven cleanly and quickly through the heavy plates. They were cut as evenly and accurately as those sections above the water. The surrounding surface of steel, which was heated to a condition of molten craters by the current-bearing electrode to facilitate the work of the arc-cutter, rapidly resumed its normal smoothness when the work was accomplished and the electrode removed.

Without this ingenious instrument it probably would have been necessary to employ dynamite in the salvage operations on the *Lord Dufferin*, and in consequence much valuable material would have been destroyed in the process of saving the rest.

This waste, once considered unavoidable, was entirely eliminated by the under water arc-cutter.



Pitchforks that carry hay from the ground to the loft

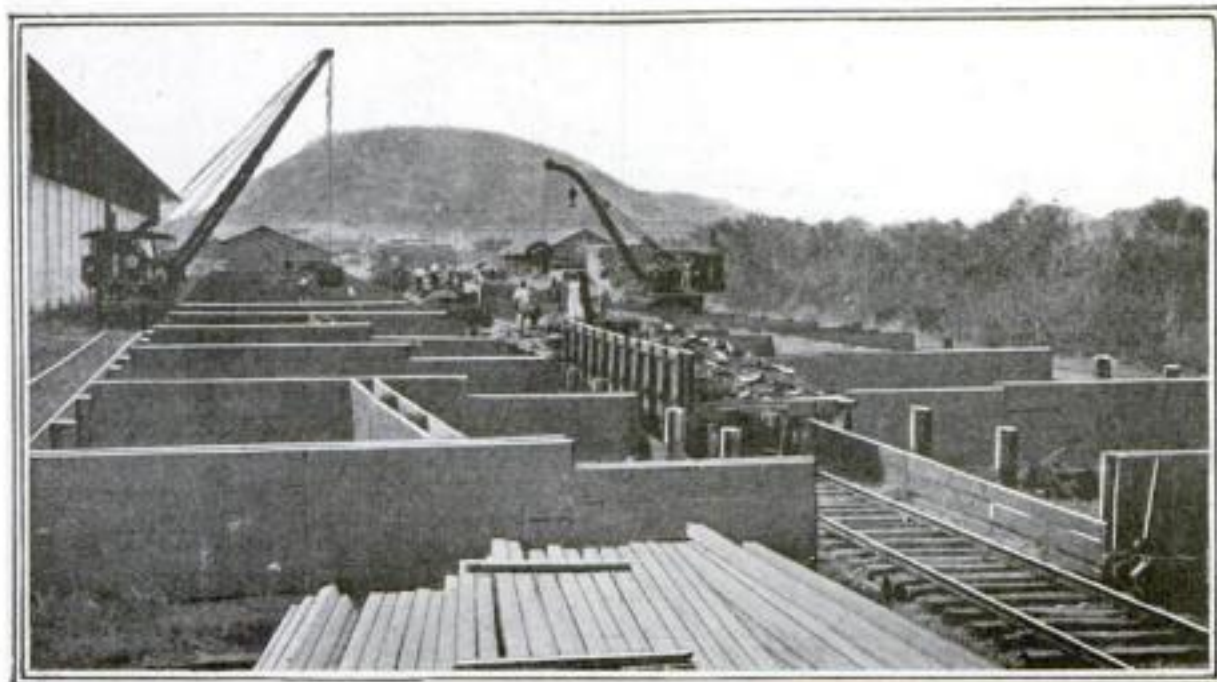
## The Great Junk-Heap of Panama

**I**N the thriving town of Balboa on the Pacific side of Panama, junk and scrap that has accumulated during the building of the canal is gathered, classified, and sold. There is a scrap dock eighty-two feet wide and five hundred feet long that has a capacity for fifteen thousand tons of scrap.

In the wasteful days before 1914, valuable

left-over pieces of iron, steel, copper, brass, and finished rail were dumped into the jungle. But since that time scrap gangs have gathered approximately three hundred thousand tons of junk.

A large percentage of this scrap is made up of obsolete construction equipment left by the French Canal Company years ago.



A great scrap dock has been built at Balboa at the Pacific end of the Panama Canal. Junk left from building the canal is sent there, classified, and sold

## Automatic Pitchforks

**G**ETTING hay into the hay-loft is one of the farmer's problems. Farm helpers are scarce and, in consequence, high-priced. But there is a new machine that acts as a hay elevator, and requires but two men in attendance, one on the ground to do the loading and the other in the loft to rake off the hay when it arrives.

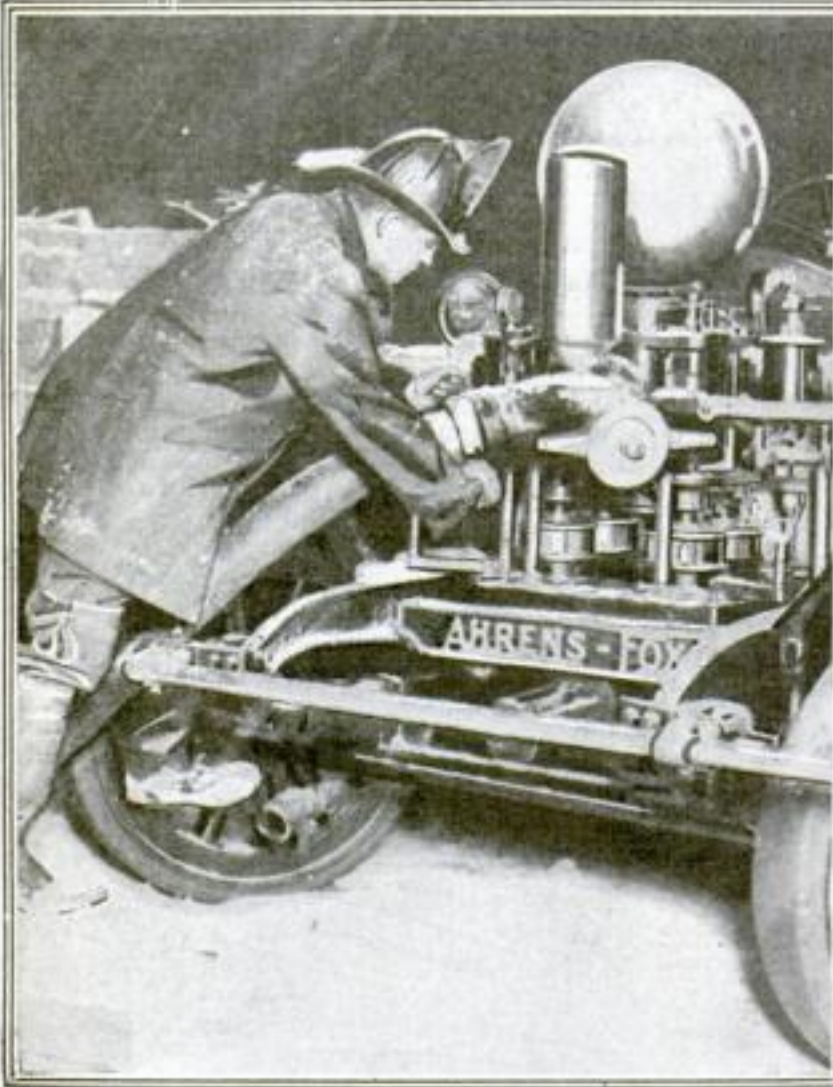
The elevating is done by a well spiked endless chain, like a series of pitchforks, that revolves around a trough. The trough, mounted on wheels, is raised to the required angle by a windlass before the chain is set in motion. The chain may be revolved either by a handle or by a pulley connected with an engine. When the hay is dumped in the bottom of the trough the spikes come along and carry it up to the top.

If front wheels of the wagon base are set at right angles to the wagon body they can be moved backward and forward in a wide semicircle.



# Brawn versus Brains in

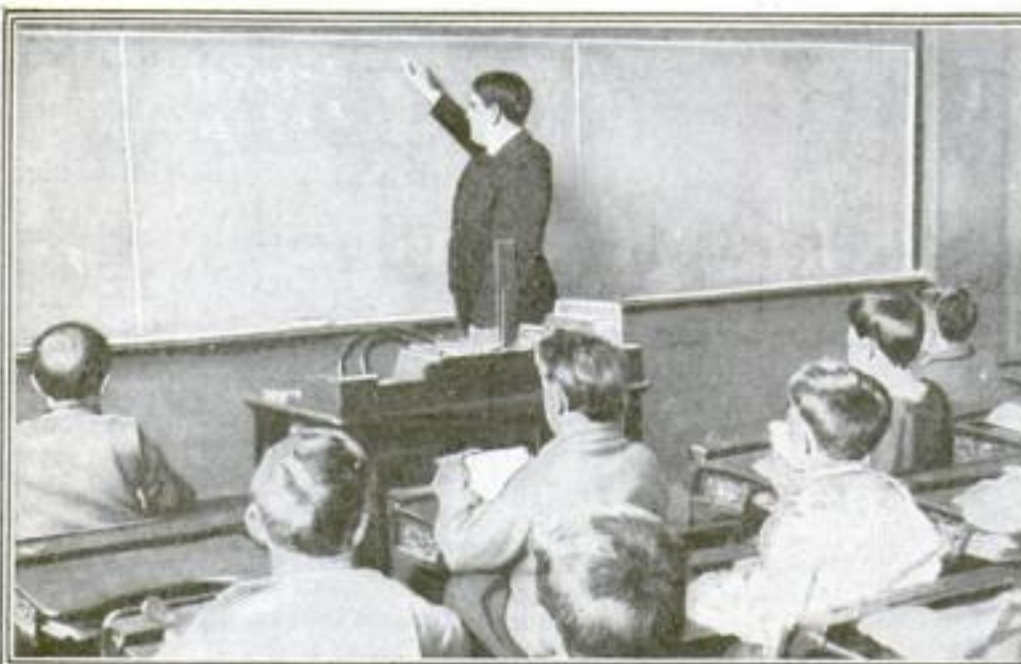
## Society pays more for services of window-cleaners



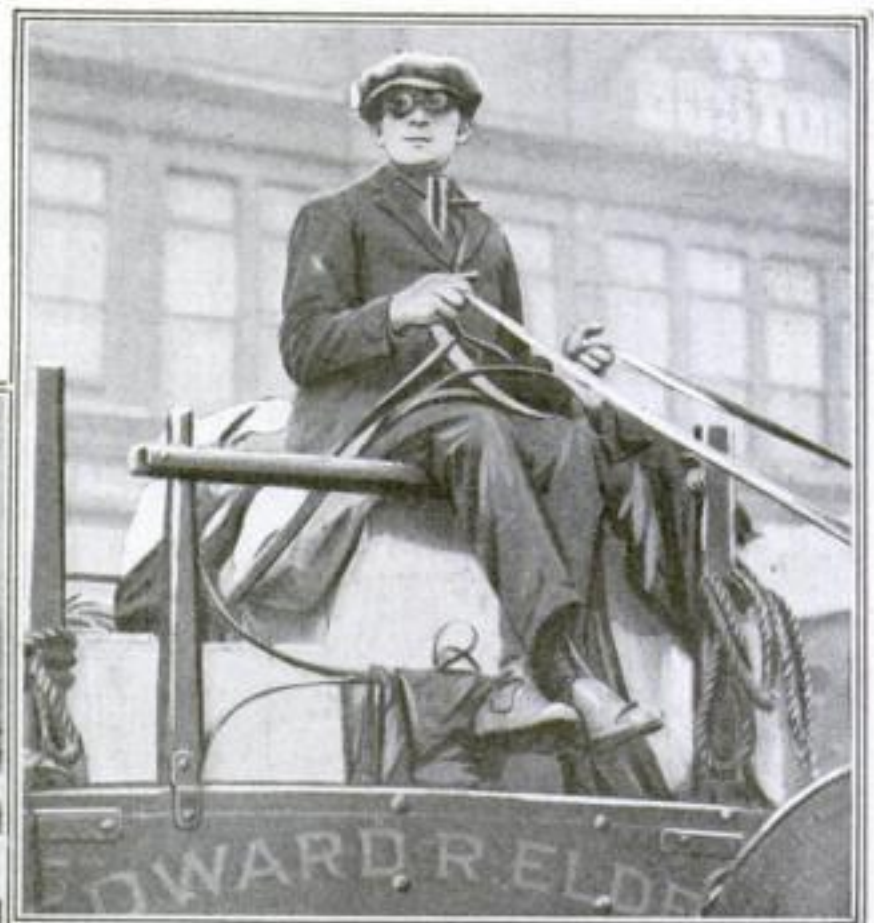
Here is a man who must be an American citizen, must pass the civil service examination and acquire technical training for his work. It is necessary for him to be physically sound, and he is often called upon to tax his strength to the utmost. Moreover, in the performance of his duty it is frequently necessary for the fireman to risk his life to save the lives and property of others, and he braves danger as a matter of course. There is no question of his value to the community. But his courage and his value receive scant acknowledgment from society which pays more for its clean windows. The fireman, with his skill and technical training, receives only half the remuneration accorded the bricklayer. His pay is about \$30 a week



No one would think of trying to run even a small business without keeping an account of receipts and expenditures. This is the gage that regulates the conduct of business, and the records must be carefully kept. The bookkeeper's place in the business world is one of importance. He must be a man of ability and education, and especially trained for his work, to which he must bring a certain natural fitness. Society demands of him that he be a man of alert mentality and a stable character, capable of long and steady concentration. There is no variety in his work, and his hours are those of the day laborer. His necessity to business is established. But the financial recognition accorded the bookkeeper is comparatively slight. If he receives \$40 a week he must be a good one



The men and women of to-morrow are being trained in the school-room to-day. There is no work more important to society than that of the teacher. His task is not an easy one, and requires years of education for it. The salary of the average teacher is about \$20 a week

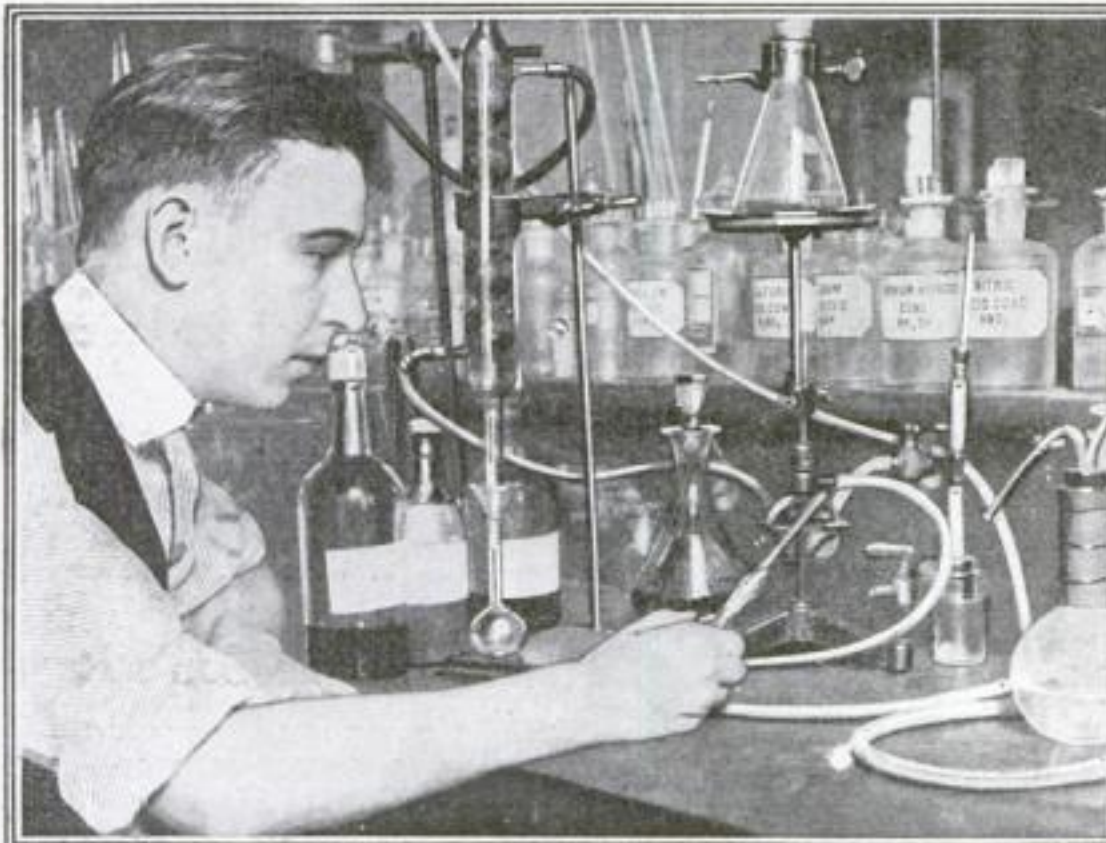


The pendulum of wages swings to the other extreme—to the job that demands more brawn than brain! Consider the teamster. The man who drives a horse and delivers your boxes or trunks is paid for his service a minimum of \$31 a week if he is an eight-hour-day man. It is possible for him to make far more by overtime work. He steps into his place without the need of years at college, or the years of specialized effort demanded of the teacher and the chemist



# the Struggle for Existence

than for those of highly trained white-collar men



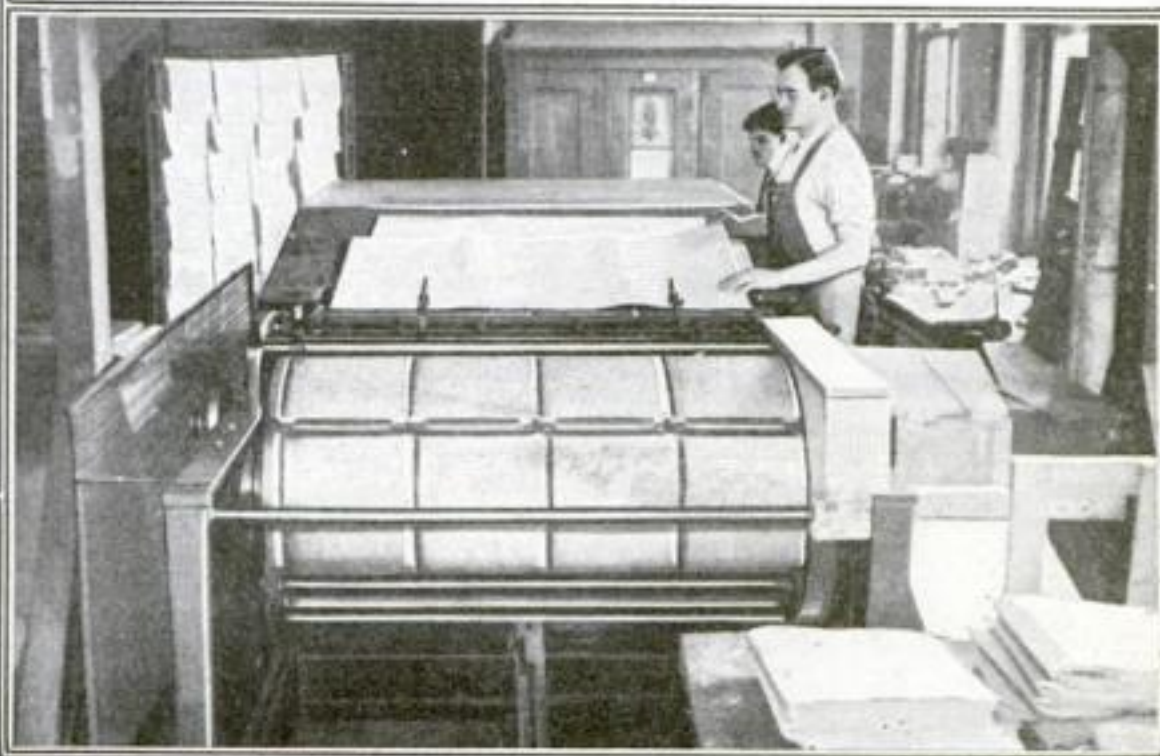
The man in the laboratory analyzes our food, and public health depends much on his devotion to his work. His value to industry is recognized, and science owes many of her great discoveries to the chemist. Yet society rewards his services with an average pay of \$40 a week



A school-teacher who tires of his job need not worry if he can get one washing windows. He will certainly fare better as far as pay is concerned and the hours will not be as tedious. The pay for organized window-cleaners starts at a minimum of \$32 a week and extends to more than \$40. But clean windows are a necessity. It is a question whether a window-cleaner would swap places with a school teacher, though the work of the teacher is considered higher in the social scale



Here is the prince of brawn workers. The bricklayer receives \$60 a week. Although his work requires a degree of skill, he needs no education for it, and he may even be unable to speak or write the English language. His children go to school to a \$20-a-week teacher with education and training



The pay of a printer ranges from \$36 a week to \$14 a day, if overtime is counted. He does not need to exercise his brain to any great extent, nor does he require much education. His job is a mechanical one that involves no danger like that of the fireman, nor is it so taxing as that of the bookkeeper





Out-of-door sleeping is made comfortable by this canvas house built on a folding cot

## A Room and Bed

**A**DVANTAGES of an enclosed sleeping porch with none of its expense are provided by a folding cot with a small canvas house built on it. The canvas covering fits over a light frame and buttons to the sides and ends of the cot, so that the sleeping quarters can be made ready or dismantled in a few moments.

The sides of the cot house are provided with openings, netted to keep out mosquitoes and furnished with flaps that can be let down. There are also windows at each end. The cot is designed for use on open porches or on camping trips.

## Tongues Out!

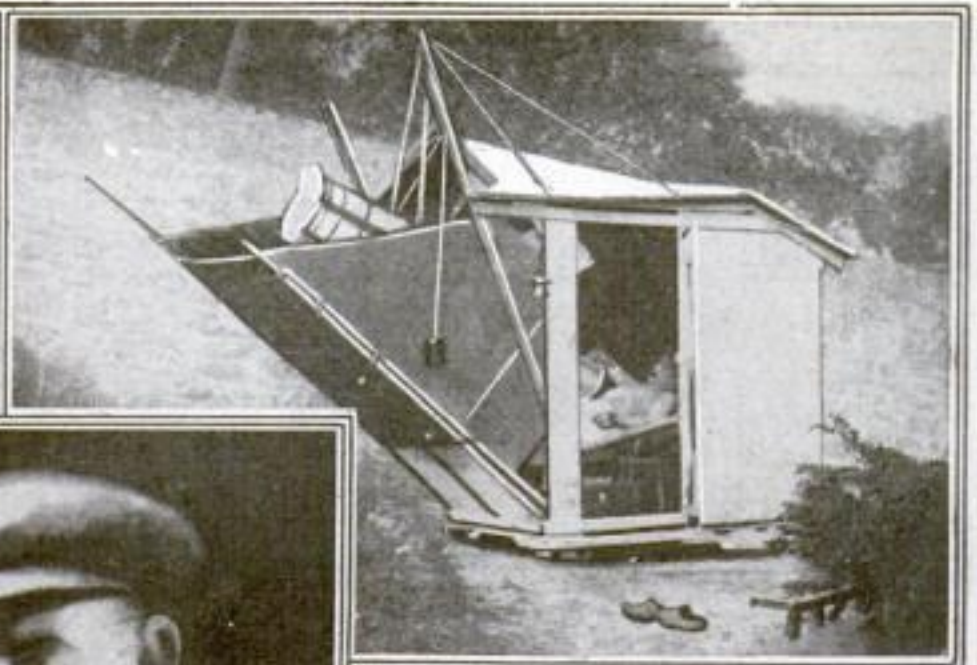
**W**HAT a fine excuse these children have for sticking out their tongues! Their totem-pole does it, so why shouldn't they?

But you can readily see from the mischievous expressions on their faces that they are simply taking advantage of their religion. Extending the tongue is a religious rite among the Maoris.

They are Polynesians. Tattooing is their specialty; sometimes they cover their entire bodies with elaborate designs.



Maori children enjoying a rite of their religion which calls for tongues out!



Cabin and lens for concentrating sun rays on a patient's body. The invention of a French physician

## Harnessing the Sun's Rays

**T**HAT the rays of the sun can be used for curing many skin diseases, and that sun baths are beneficial to those who are in perfect health, is well known. The problem of utilizing this agency in northern countries where the hours of sunshine are few has been solved, he claims, by a Brittany doctor, M. J. de Thezac.

His invention consists of a revolving cabin, combined with a huge lens for concentrating the rays on any part of the enclosed patient's body. This installation has just been tested in the neighborhood of Quimper, France.



The blind man tells time by a watch on which raised knobs represent the hours

## Feeling What Time It Is

**"L**ET me see what time it is," says the blind man, falling unconsciously into the speech of those with eyes. But what he actually does is *feel* the time.

He has a watch made especially for the blind. Instead of figures on the dial there are raised knobs, and the watch is so constructed that the owner can run his fingers over the face without damaging the hands.

One knob means one o'clock, and also four, seven, and ten o'clock: for the hours two, five, eight, and eleven there are two knobs, and for the hours three, six, nine, and twelve there are three knobs.

## The Writing on the Rock

**N**O wonder the Chinese worship their ancestors! They are always coming across some great work that their ancestors did. At Amoy, for instance, are huge rocks covered with Chinese characters carved on them many centuries ago.

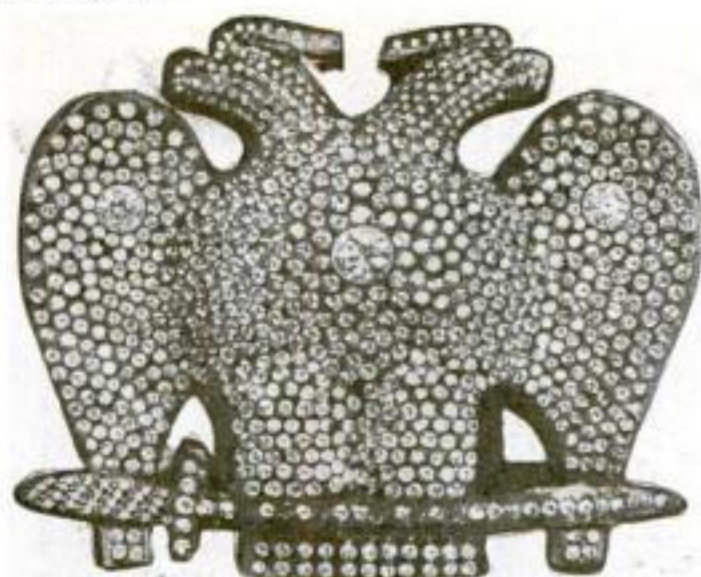
How did the honorable ancestors scale the sides of the rocks? What instruments did they carve with? Why did they do it?

The monstrous rocks covered with these carvings are larger than houses. The Chinese dwelling in the picture looks very small beside its towering neighbor.



Hundreds of years ago these Chinese characters were carved on the great rocks of Amoy





Perhaps the most valuable bird in the world is this double eagle of diamonds

## A Diamond Double Eagle

**T**HERE are nine hundred and fourteen diamonds in the wings and body of the double eagle which represents the emblem of a Scottish Masonic order. It is valued at \$25,000, and its weight in diamonds is a little over one hundred and ten carats.

Forty-eight rubies glow in this amazing field of white brilliance which measures four and one half by five and one half inches.

## Are We Going to Have Thirteen o'Clock?

**"A**RRIVING nine o'clock, Saturday," says the telegram. But there are two nine o'clocks in Saturday, one in the morning and the other at night. Time as it is now told may be confusing. That's why England is trying out a twenty-four hour clock in Greenwich. If it is adopted it will do away with the confusing A.M.'s and P.M.'s.

Clock faces will be enlarged to accommodate the twenty-four hour marks and the usual Roman numerals will very likely disappear, Arabic numerals taking their places.

Whether thirteen o'clock will represent the day or night time one o'clock of old has not been announced.



The twenty-four hour clock proposed by England will make one round a day

## Our Midshipmen of the Air Sail High

**W**HAT a thrill, to swing at the end of a rope ladder, dangling at an altitude of a thousand feet in the air! When the balloon begins to rise the earth falls away below and the mountains of vapor overhead loom closer and larger. Objects on the ground or upon the sea become smaller, until finally the unaided eyesight cannot distinguish them. Then the men of the balloon corps take their marine glasses, cameras, or telescopes and bring the earth's details into better view.

When a number of free balloons are "let go" it is curious that they do not all travel together in the same direction. The explanation is that air currents are different at different levels. If one balloon rises higher than the others it may be caught in a current that will whisk it away in a totally different direction from its companions.

In a balloon race that started at St. Louis, Mo., one balloon traveled a distance of 1,050 miles; another went 920 miles; while a third reached only 860 miles from the starting point.



Dangling in the air from a rope ladder is sport for the midshipmen of the air



The dial enables the building engineer to calculate rapidly the weight or size of structural parts

## It Measures Dimensions

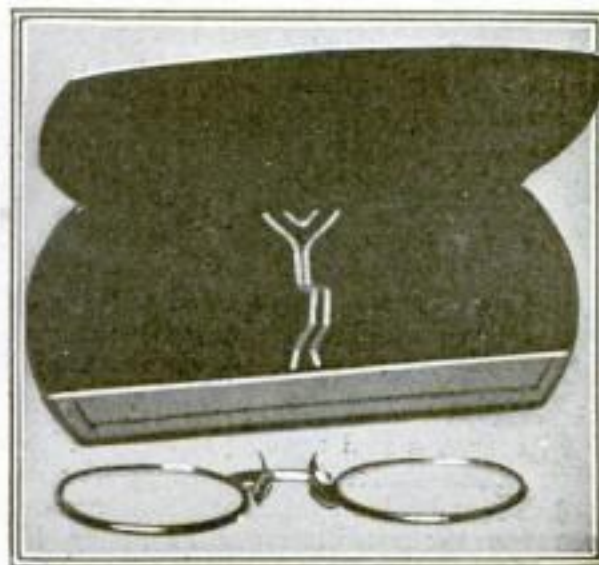
**T**HE rapid dial calculator is a handy instrument for the building engineer and others who would find quickly the results of figures in the building of standard forms for reinforcing. It enables one to find at once the depth of a concrete beam to carry a given load, or to find the size of concrete slabs and beams of different carrying capacities. It may also be used to figure the thickness of wooden planks and boards to carry certain loads, or to check the relative dimensions of wood or concrete beams and slabs designed to carry the same loads.

A few movements of the disk of the dial and the figures can be read from the face of the calculator, a little work is done with the pencil, and the facts are known.

## To Protect Eye-Glasses

**A**S the train started with a jerk the elderly man was thrown violently against the man ahead of him in the aisle. While making his apologies he hurriedly pulled an eye-glass case from his vest pocket, and one glance told him that his reading glasses were broken.

The man with whom he had collided pulled out his own case. "It wouldn't have happened," he said sympathetically—"the breakage, I mean—if you'd had this," and he displayed a piece of brass wire formed to fit inside the case and having a hump in the middle to keep the cover in place.



Helping the case keep the glasses safe is the job of the bit of brass





Cots are quickly made comfortable in a folding tent frame that serves for camping or in field hospitals

### Here's a New Folding Tent for Tourists

A TENT frame which will fold up to be stored in a small space and which when open will be rigid enough to hold the canvas without sagging in wind and rain, is the invention of Monroe Buck, of Glens Falls, N. Y.

Four corner posts are provided, each formed in two sections. A folding tie-beam held in place by a brace serves as support for the cots. Metal strips which hold the cots in position can be removed by unlocking.

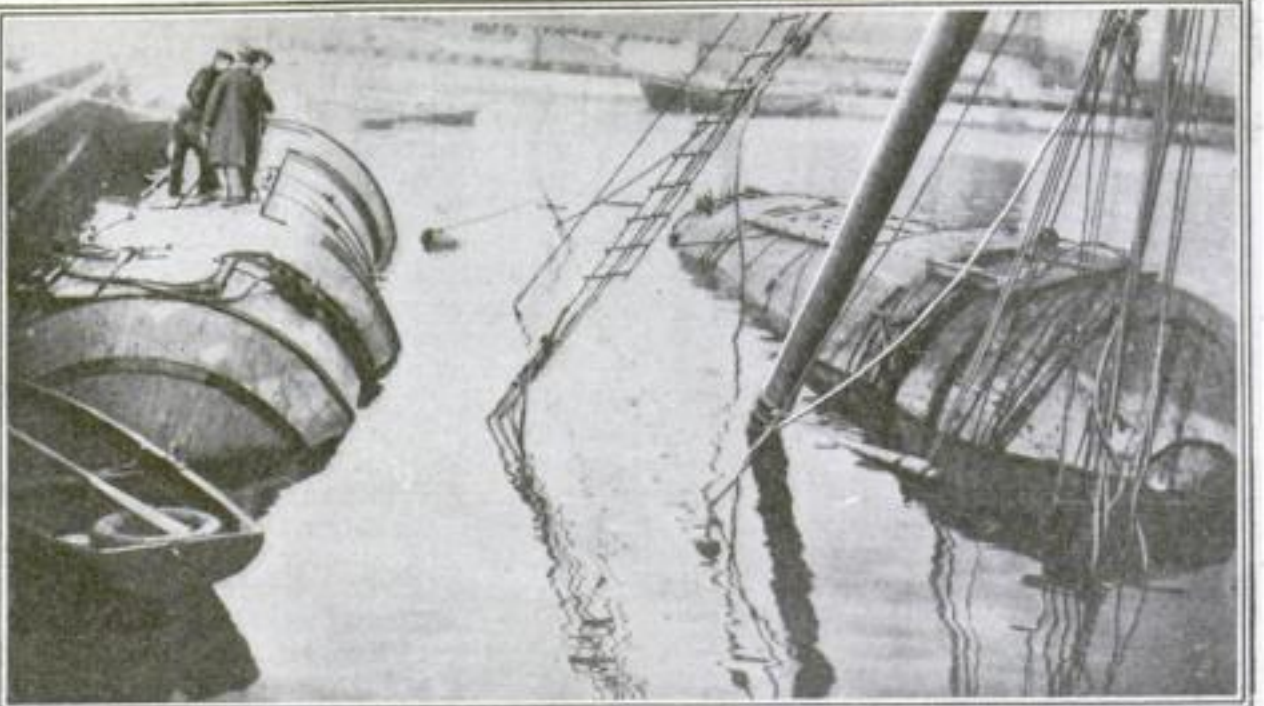
The automobile tourist who would enjoy the full outdoor life can carry the tent attached to the side of his car. The tent frame is also serviceable where field hospitals are required.

It is so simple in construction that one man can easily handle it and erect it.

### A Tip from the Circus

AS the lady in spangled tights seemingly defies laws of gravitation on the flying trapeze, she and the audience are saved from the possibility of one thrill too many, by the life-net stretched below. The decks of a submarine offer scarcely greater security than a trapeze, so taking a tip from the circus, men at work on the U. S. S. R-13 in dry dock at Boston stretched a net around her when they had the job of fitting up a deck gun during slippery weather last winter. When a workman slipped and slid down the slippery sides of the hull, he landed lightly and safely in the life-net.

Of course a real sea-dog is supposed to have fishhooks for fingers and to be able to hang on by his eyelids when necessary, but the life-net increased efficiency by increasing confidence. Just astern of the submarine in the picture is the U. S. S. *Savannah* being fitted up as a "mother ship" for the R-13 and her kind.



### Glass Houses for Marine Searchlights

ALUMINUM pontoons having glass-walled chambers on their under sides are a recent invention for the aid of salvagers. It is often necessary to have a strong light which can be cast downward along the side of a sunken hull. With powerful electric lights mounted in the glass chambers of the aluminum pontoons, it is possible to direct the light in almost any manner desired.

Divers are enabled to see how to attach hawsers to the hulks, or they can repair

A sunken ship with aluminum glass-chambered pontoons on each side of it



Falling overboard from a submarine in drydock would be bone-breaking business were it not for the life-net



A tongue- and groove-locking device protects this box against the unscrupulous who make use of famous labels

### A Self-Destroying Box

THE principal reason for non-refillable bottles has departed but unless the candy habit is amended out of our constitution the non-refillable box has a useful future. The one illustrated is the invention of Paul Richard, of Lebanon, Pa., who has devised a way by which the box will be so damaged in opening as to be useless for repacking, but not so broken as to spill the contents. He relies on a tongue and slot to do the trick.

In the box cover at the right of the illustration can be seen one of the two tongues which, when the cover is placed on the box, slip into the slot visible in the box at the left of the illustration. It holds the cover locked to the box so that to remove the cover the locking tongues must be torn out; thus insuring against the duplicity of man which sometimes leads him to put inferior goods in boxes with famous labels. Manufacturers who have given years to making their labels familiar to the public, and establishing their guarantee of "good goods," have given these labels a distinct value. Before the advent of the self-destroying box there was no way of circumventing the man who appropriated them.





Transferring caterpillars from one plant to another on a butterfly farm to give them fresh food

## Raising Butterflies for the Market

ANYONE who wishes to try farming where small capital is needed might well turn his attention to butterfly culture. At least one man, Mr. Newman, of Kent, England has found it profitable. He supplies schools and private collectors with specimens and sometimes receives as much as \$50 for a single butterfly. He has customers in all parts of the world.

All that is necessary is a small garden in which many varieties of plants will grow, with some knowledge of the habits of the insects. You find the female butterfly feeding on its favorite plant, enclose her in a small gauze bag tied over the food plant as a safeguard against enemies that would destroy eggs or the young caterpillars, and then watch while eggs change to caterpillars. These spin round themselves silk shrouds, or change by degrees into strange-looking mummy cases. Within two or three weeks a moth or a butterfly will emerge from the shroud. On the Kent butterfly farm over 70,000 caterpillars are maturing at one time producing an average of 500 butterflies a day.

The caterpillars are held prisoners on a plant by the gauze bags tied over them

## Return Empty Crates for Refilling

AN empty crate traveling back to the shipper takes as much space as a filled one and for that reason most crates are a dead loss after being used once. To avoid this waste Eugene B. Johnston, of Glen Hope, Pa., has devised a folding crate which takes but little space when not filled and can be used many times. It has hinged

Folding a crate to be returned to the shipper to use again

end and side walls which fold and hooks at the ends that catch into a slotted plate which holds the walls in an erect position when in use. The crate has reinforcing slats to enable it to withstand rough usage. These are so placed that they lie under the end slats when folded.

## Cousins of the Chinese?

HUMBOLDT, the great naturalist, suggested long ago that the Alaskan natives came from Mongolian stock. This belief gains strength when we compare the arts and crafts of the Alaskan Indians with those of the Chinese and Japanese. The haired and bearded mask shown in the photograph is the work of Kuskoquin Indians, but it is very like the war masks of the early Mongol warriors. The figure on the left, another of Indian production, represents in form the art of the ancient stone workers, specimens of which are found in the southern Yenisi Kurgany region by Marie Antoinette Czaplicka, who headed the Oxford Siberian Arctic Expedition and who is now lecturing in this country.

The baskets shown in the illustration are the work of the Attu Indians of Alaska, a fast disappearing race. The baskets are woven under water from a very fine tough sea-grass which seems also to be disappearing.



© Photo by William Thompson

Did our Alaskan Indians come from China? Their craftsmanship suggests the possibility. Examples of their art are curiously like that of ancient Mongolia



Nut picking device to help California harvest a fifty million pound crop of walnuts

## Trapping Walnuts

PICKING fifty million pounds of walnuts in California's 1920 harvest will be simplified by the nut-trap invented by J. F. Franke, of Santa Ana. The device is an iron funnel attached to a long wooden handle. Wires extend down the sides of the funnel curving upward at the bottom to end in coils hung inside the funnel. The walnut-picker drops the funnel over the nut on the ground, presses it to open springs which close again over the nut, like a trap.

## The Vampire

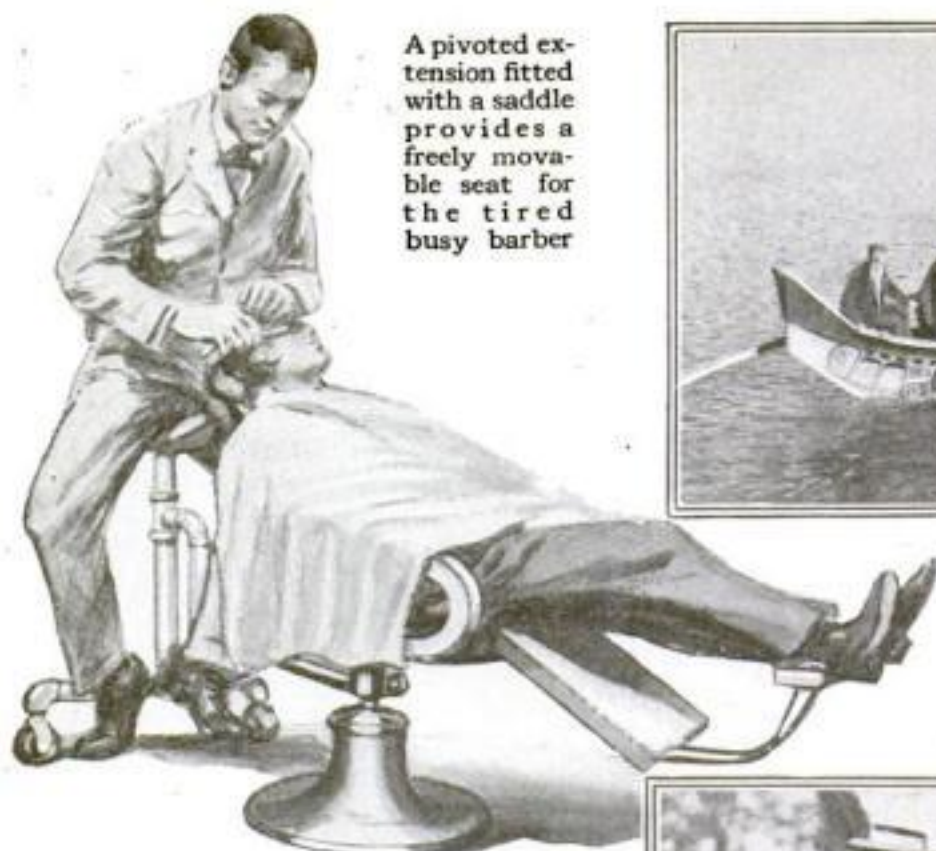
IF you have never seen a real vampire, prepare to see one now; for a picture of one appears below. "But she's not beautiful or even fascinating!" you say. Ah, no! A genuine dyed-in-the-wool vampire is an ugly old bat that steals forth at night and bleeds her victims—usually chickens.

This bat and many like her live in the neighborhood of Kalacoon, British Guiana. There is a Zoological Research Station there and one of the men connected with it says "These vampires drew the blood of our pets and chickens but never molested us though we often heard the swish of their wings and felt the air fanned as they brushed our faces."



The vampire as she really is





A pivoted extension fitted with a saddle provides a freely movable seat for the tired busy barber

### A Seat for the Barber

**I**NSTEAD of having to stand, while he shaves a patron or cuts his hair, the barber can now take a seat, and easily move himself around from one side of his victim to the other.

The long-whiskered man holds no terrors now for the tired barber. Seated upon the saddle of an iron extension fixed to the chair, he can take plenty of time to do a good job, propelling himself around comfortably with his feet on the floor.

### Carry a Light About Without Holding It

**"YOU'LL** have to take another man with you to hold the light," warned the night foreman as Big Jim started in a dark corner of the plant on a trouble-hunting expedition to the power switch-board. But Big Jim only grinned. "See this little jigger?" and he snapped on to an overall suspender-button a battery-lamp so that it hung just below the level of his face and threw its beam this way and that as he moved his body. "This is as good as daylight, and I've got both hands free for the job."

Big Jim's "little jigger" was just a convenient application of the familiar electric battery lamp.



This electric battery-lamp has a device for attaching it to the workman's chest, leaving his hands free



Chief Shake now keeps this historic war-canoe in the grounds near his house

### Chief Shake's War-Canoe

**I**N past centuries Mongolian tribes navigated long expanses of the Pacific in their war-canoes and these voyages led to the migration of the peoples of the Far East to the islands of the Pacific.

Between the Maori war-canoe and the Alaskan Indian dug-out there is little, if any, difference in construction. The size of the Maori craft was limited only by the size of the tree from which it was hewn.

The picture represents the most elaborate war-vessel that remains as an example of these staunch and highly artistic craft in which voyages were made for either conquest or discovery.

The one shown is the property of Chief Shake of Wrangel, Alaska, and was used for many years on the Stikine River, plying between Wrangel and Telegraph Creek, a distance of about 180 mi. It now rests near the house of the Chief, a relic of the prowess of a race that soon will be gone.

### A Glass of Water with a Kick

**"WHAT** a kick!" exclaims the drinker when he takes a sip of the most modern prohibition drink.

A wire connected with a medical coil, its free end connected with a metal container in which is a glass of water; this is the mechanism. Hold the metal container and place your foot on the side of the kitchen stove, or on any other piece of metal, take a sip of the water, and the "kick" will be very perceptible. It is harmless, however, because the electric current which passes through your body at the time is weak.



"Electrify" your friends with a glass of the latest prohibition drink: the current gives the kick

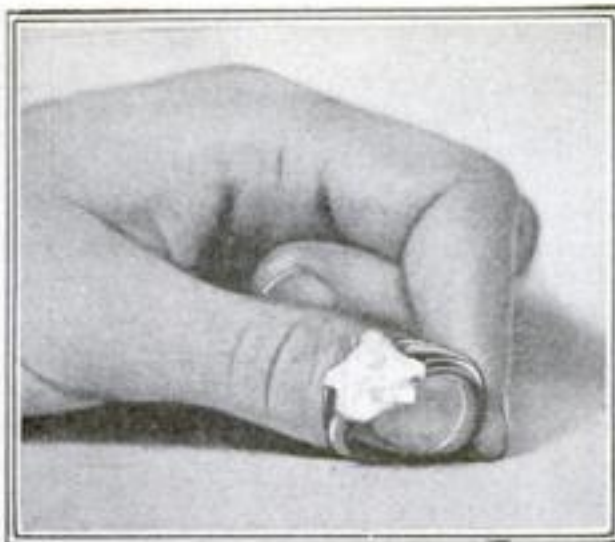
### The Man Higher Up

**S**TILTS and their troubles fade into insignificance before the new unicycle shown above. The more we look at it the less we seem able to explain how the owner manages to stay on top and read his morning paper so unconcernedly.

The small wheel is far below him. He sits on a saddle and pedals with his feet, but he has no other visible means of support. His situation suggests that of the impecunious gentleman whose wife supported him on her needle.

How does he start? How does he stop when he gets in heavy traffic? How does he keep his balance between times? And, finally, how does he steer himself around corners?





The diamond in this ring is covered with paper through which flaws in the gem show with startling clearness

## To Detect Flaws in Diamonds

**C**OMMON white cigarette paper will help to show flaws in diamonds. First, to clean your ring thoroughly, roll up a single white paper into a compact cone-shaped roll, smaller in size than a match; insert the pointed end of this between two prongs of the ring, and draw it all the way through. Clean thus between all the prongs. Finish by polishing the surface of the stone with a crumpled-up paper.

Now take a fresh paper and, holding it at right angles to the ring, place the center of it over the stone. Fold each end down, holding between thumb and finger. Touch your tongue to the paper-covered diamond, to moisten it. Any black spots in the stone will now show through in a startling fashion.

## All Four Feet Off the Ground

**T**HE eye cannot determine whether or not a horse's four feet are all off the ground at one instant, but the camera has definitely settled the question. The lens winks and catches in one brief look the position which to the eye of man merely blends in with a blurred series of positions.



The camera caught this horse when his four feet were all in the air at once, thus settling a question often discussed

## A Traveling Bar Is a Convenience of the Tropics

**O**NE needs a steady head to be a barmaid in the Barbados; witness the barmaid in the picture. The photographer who took it says that the liquid coming from the spigot is beer; of course the plan would work as well for lemonade or just plain water.

The liquid in the container is kept cold by being set in chopped ice in what looks like a cheese-box minus a cover. The cheese-box rests on a blank cut to fit, and the whole edifice has as a foundation a kind of inverted bench that keeps the cold from penetrating to the head of the barmaid.

We wonder if any of the drops ever deflect toward the barmaid's mouth.

She carries an ice-box on her head to provide cold drinks for the thirsty



To fill a lantern without spilling the kerosene, attach a short rubber hose to the spout of the oil can, like this

## Filling Without Spilling

**"T**HERE goes the kerosene, spilling over everything." This is a common expression when one tries to fill the lantern from the ordinary oil-container. The "coal-oil" can has a short spout, and when the can is full it is difficult to make a neat job of filling the lantern. If a short piece of rubber tube is attached to the spout of the can, it enables one to tilt the can at a smaller angle during the filling, thus obviating the necessity of much cleaning-up after the lantern has been filled.

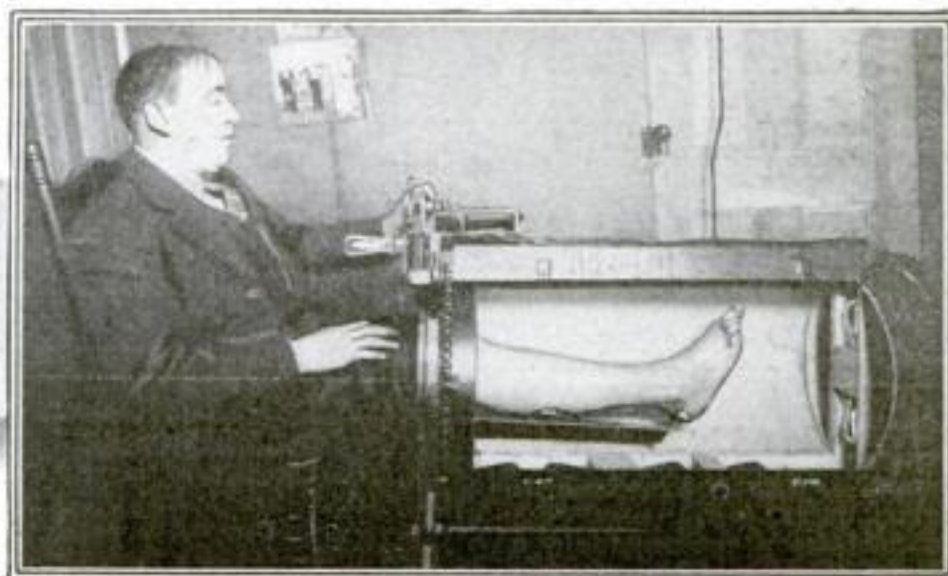
## The Mysteries of the Light that Cures

**W**HITE light, split into its principal divisions and displayed in spectral beauty, is as useful as it is ornamental.

The invisible rays beyond the red end of the spectrum, the infra-red, have marvelous powers of penetrating the dense regions of the atmosphere, and photographs of distant objects show more detail when photographed through the red-transmitting filters.

The yellow-green region of the spectrum comprises the rays that enable us to see all the objects around us in their beauty of color. This range of light extends from the visible red to the visible violet. Just beyond the violet is the range of invisible ultra-violet rays.

The light-waves of such extremely short length that they do not affect the retina are possessed of curious chemical powers. They strongly modify the photographic emulsion and cause chemical changes in animal and plant life.



An invention of the late Oscar Hammerstein which has recently been perfected by Mrs. Hammerstein, utilizes the rays of violet light to cure rheumatism in the manner pictured above

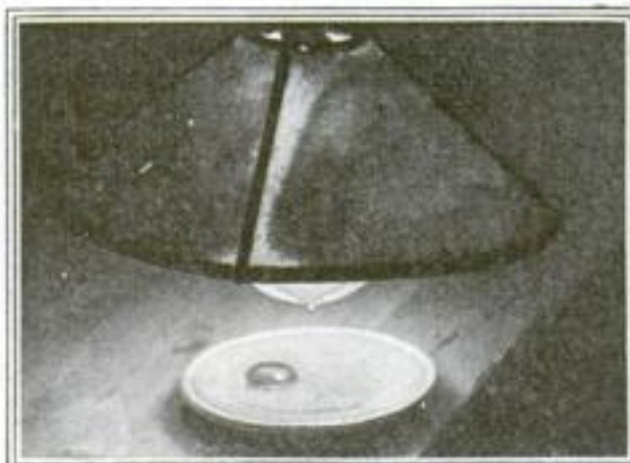


# Housekeeping Made Easy

Little things that help systematize kitchen work



Separating an egg becomes a successful operation if a funnel is brought into use. The white of the egg runs through leaving the yolk intact



When the gas is turned off and one possesses no electric grill, eggs may still be cooked by electricity. A fifty-watt nitrogen lamp will throw sufficient heat upon them to cook them perfectly



Raising bread is a delicate operation. An electric light placed in the oven under pans of dough makes the bread rise just the right degree



A pair of ordinary coat hooks and a discarded curtain rod are the only things necessary to make a convenient towel rack. It has the advantage of being longer than the ordinary rack for towels



This simple wire rack when screwed to the wall back of the stove accommodates all pot and pan covers making them easily accessible to the busy cook



Here is a frame calendar with twelve slip-in sheets for the months. The frame embodies a glass front which keeps the sheets from accumulating a layer of dust. The calendar-holder may be made of any picture frame of convenient size, with a slit cut in the back



This kind of rack keeps the air pure for fresh vegetables and may be used also for cooked food. The unsanitary fly can only sit on the outside and look in



Only one trip around the pie-pan is necessary now, for a new kitchen-tool crimps and trims away the pie-dough in one operation. The tool embodies a notched, wooden wheel and a small knife-blade



Practical garden baskets made of green wicker, leather lined; contain pruning-shears, flower-scissors, twine, trowels, etc., and are indispensable to the gardener



# Do It With Tools and Machines

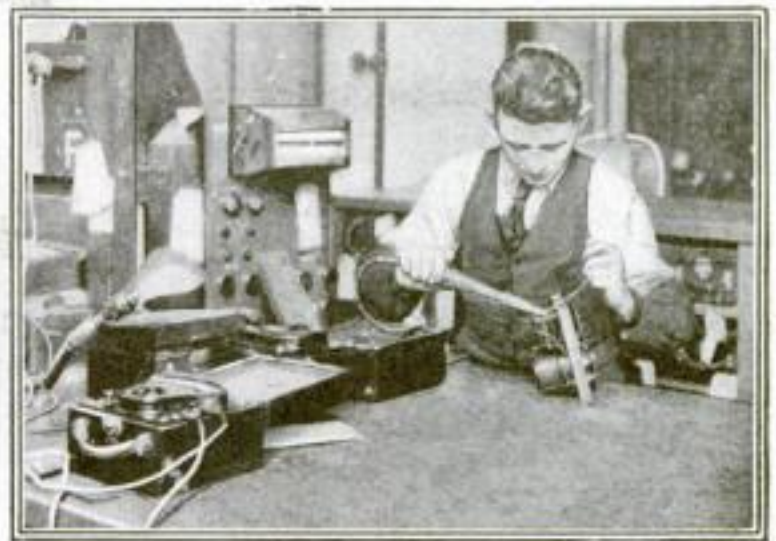
Labor-saving devices for the work-shop



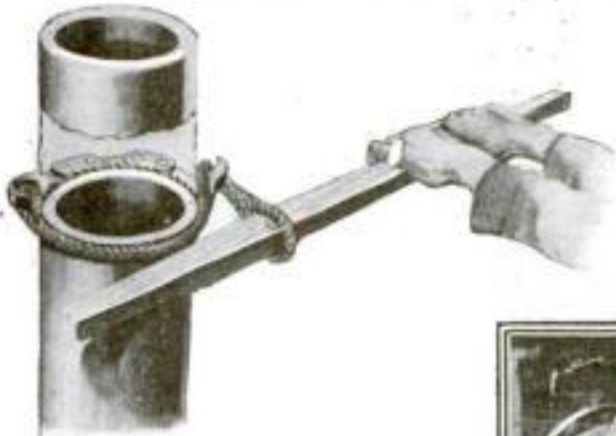
The self-adjusting electric light arm is adaptable to local lighting of any kind. It facilitates placing the light exactly where it is wanted so that it "stays put"



This illuminated tool is intended for use in dark places or where the part to be repaired is enclosed by partitions



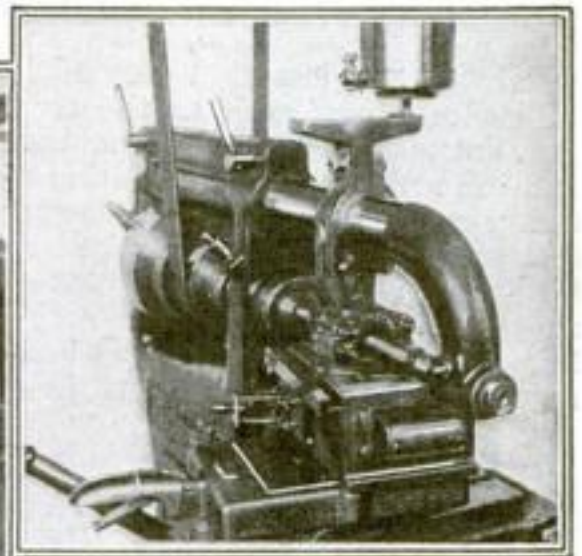
The electric soldering iron, when compared to the type heated in a gas flame or fuel burning muffler, exhibits improvements, both in operation and convenience



To obtain a grip on a round surface is almost impossible without the proper apparatus. This tool is designed to give an effective grip on a pipe



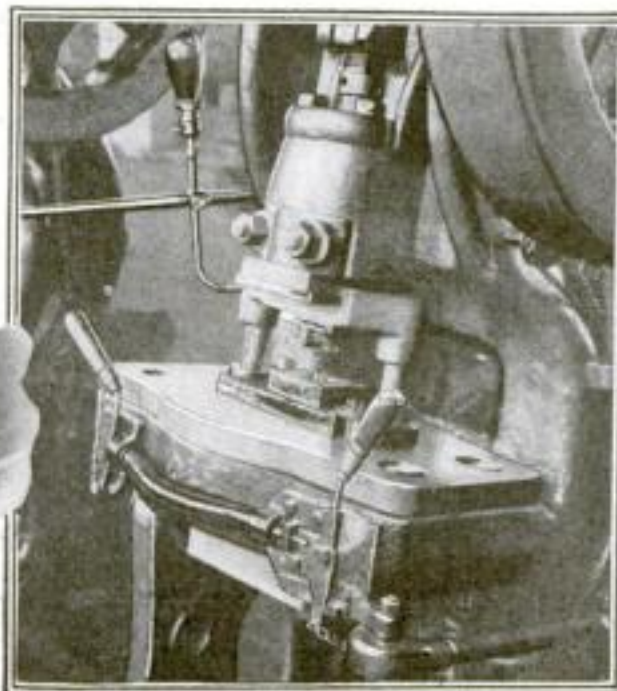
Of course you know there is a universal joint on your automobile, but did you ever hear of a wrench having one? With the wrench illustrated you can remove nuts placed at any angle



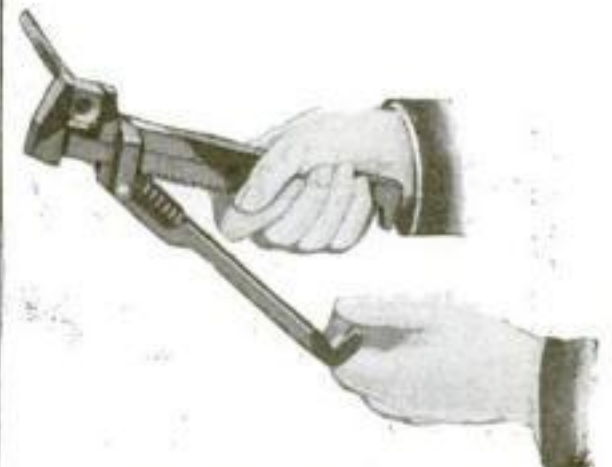
A shield renders all working parts of this grinder harmless if the operator makes a mistake. Why not promote a "safety first" campaign in your shop and speed up production?



Weighing only twelve pounds an electrically operated saw can be carried around and used on a job wherever there is the necessary current. Buffer or grinding wheels can be used on the machine in place of the saw, with equal facility



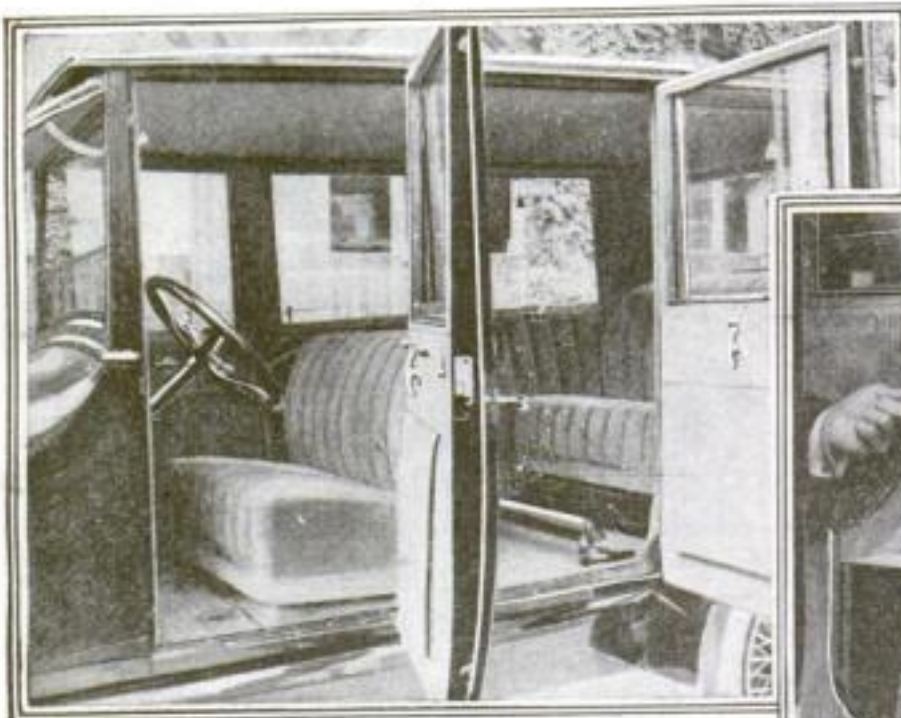
The picture above illustrates a safety-lock on the hand-trip of a punch-press which safeguards the operator's fingers without affecting the machine's production



Most of us have spent valuable minutes trying to adjust a monkey-wrench, the parts of which seemed determined to remain immovable. The jaws of this wrench may be opened quickly by moving the lever outward as shown in the accompanying illustration



# Cranking Up the Automobile Window



The handle is a crank which winds up or closes the window. It has many advantages over the old way of raising automobile door-windows

Wheels and pulley that raise the windows, operated by a handle on the door



THE greatly increased demand for enclosed cars such as the sedan and limousine caused by the more common use of automobiles during the winter months, has made it necessary that some new device be worked out for raising and lowering the windows and keeping them at the desired height. The sash-band type of window regulator in which a band of fabric

about four inches wide is employed and fastened to some fixed part of the door by a screw clamp, has not proved entirely satisfactory because the band falls in the way of one's feet when the window is raised. Then again, the clamp sometimes works loose or the band slips out of one's hands, with the

result that the window drops to the bottom of its pocket with a bang. This results in frequent breakage.

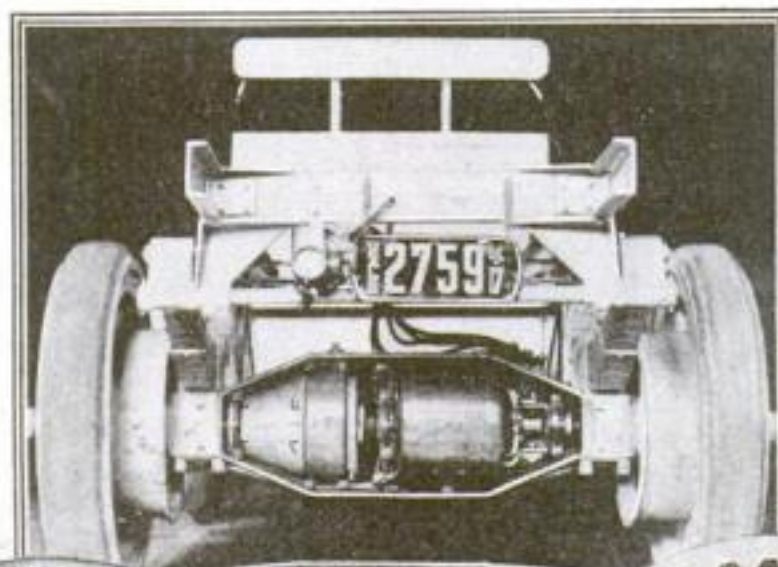
These failings of the old style regulator have resulted in the designing of a new apparatus which overcomes the faults. It is simple and inexpensive to manufacture and is adaptable to either the quantity-production car or the one with a custom-made body. The mechanism is shown in the illustrations.

The picture of the sedan with two doors open shows the neat appearance of the finished window, with but a small handle showing. The broken-away illustration shows how the apparatus is made and how it works. It consists of two gear-like pulleys over which runs a chain turned by a gear mounted on the same shaft as the turning handle inside the car. The base of the glass is attached at one point to the chain, so that a movement of the handle causes the glass to move up or down. Both pulleys are provided with sharp spear-like projections around the edge or circumference. These fit into holes in each chain link as it passes over the pulley and thus make it impossible for the window to slide downward when the car jolts or because of any unusual vibration.

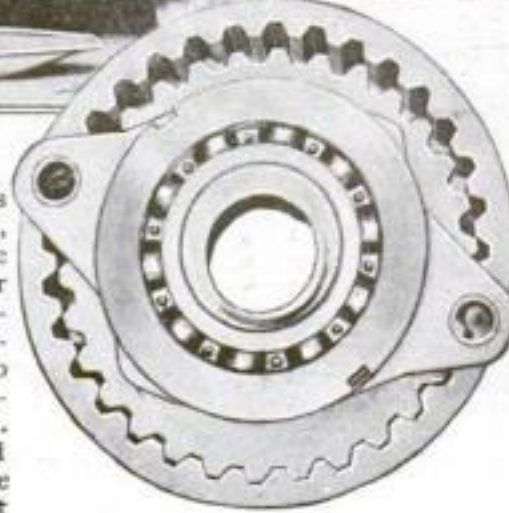
## Only Two Gears in This Electric Truck Drive

SIMPLICITY and small frictional loss of power feature the driving mechanism of a new type of electric truck in which only two gears, instead of four or eight, are employed to transmit power from the electric motor to the two rear truck-wheels. Because of the necessary high speed of 2,200 revolutions a minute of the electric motor to give it its greatest efficiency, and the low truck speed of fifteen miles an hour, it is necessary to have a gear reduction of approximately sixteen to one. In most types of electric truck this reduction is secured through a worm gearing, or a train of spur gearing in which from four to eight gears must be employed. The more trains of gears, the greater the frictional loss of power. Also, on account of the large gear reduction, one of the gears must be made

Mechanism of the unit-drive electric truck is encased in the rear axle-housing



Right—Gears in mesh, showing size and number of teeth constantly enmeshed to which linkage connect. Left—End view of the drive unit



small which results in high speed with consequent wear and need for frequent replacement.

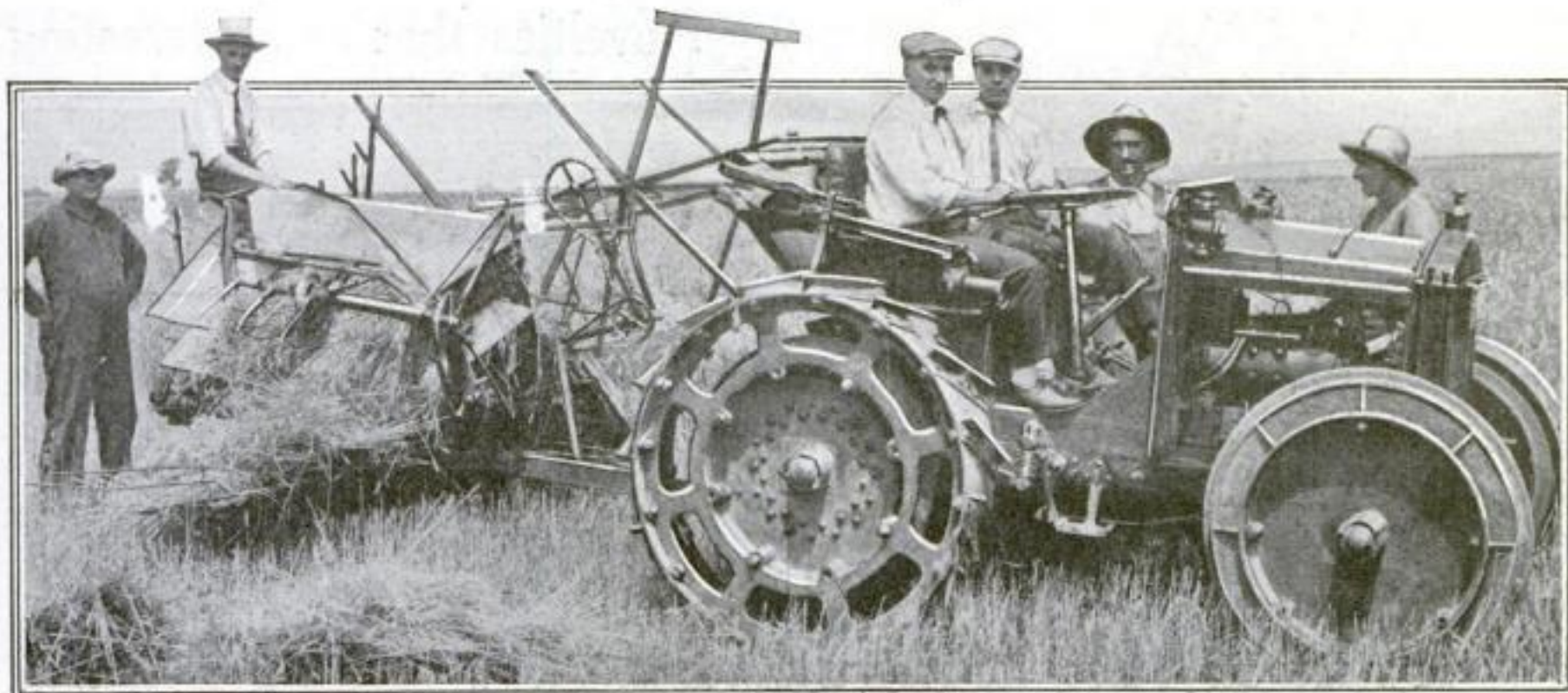
In the new form of reduction the difference in speed is secured by a pair of spur gears forming a combination of an internal and external gear. The external gear is mounted on an eccentric and is held by a system of linkage, driving the internal gear through a gyrating motion without itself revolving. By this combination, frictional loss is reduced to a minimum.

Also by reason of the compactness of this form of gearing, it may be grouped with the electric motor inside of the rear axle-housing, where it is protected from mud and dirt.

The broken-away pictures show how the mechanism of the unit-drive electric truck is encased in the rear axle-housing and how the gears mesh.



# It's a Farm Tractor and Motor Truck Too



In the illustration is shown the heavy tractor wheel slipped in place over the rubber-tired wheel. By the simple operation of removing it the tractor may be used for hauling on public highways without injuring the road-bed. In the picture the tractor is attached to a binder

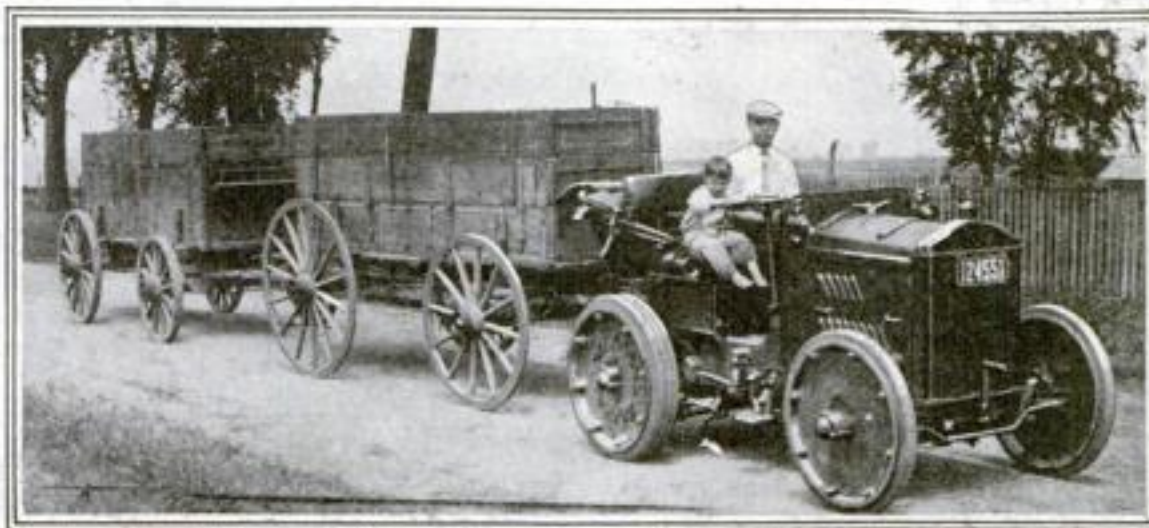
**T**HE great and simultaneous development of the farm tractor and the motor truck as a result of the more efficient farm production and better highway transportation demanded during the war, makes it logical to suppose that future development will lead to some form of vehicle which may perform both the cultivating work and road haulage of the average American farm. Due to the very great difference in the character and speed of the work to be performed, the solution of this problem has not been an easy one. The farm tractor needs great pulling power at comparatively slow speeds but for long periods, while the motor truck, because it operates over roads, requires less pulling power but more speed. Added to these two problems has been the one of quick, simple and inexpensive conversion from one type of vehicle to the other. Then, too, the tractor must be able to furnish the power for all forms of belt work and to do this without interfering with the vehicle as a road transport unit. In other words, the successful motor vehicle for the average farmer must be capable of doing all the farm work that was previously done by horses, and more.

It has been the inability of both the ordinary farm tractor and the ordinary motor truck to successfully perform all the farm work previously

done by horses that has presented the main obstacle to the more rapid motorization of the farm. While the farm tractor has been able to do most of the purely agricultural work on the farm such as plowing, disking, harrowing, cultivating, binding, etc., and also belt work, it has not been able to complete the farm operation of hauling the crops to market. This has necessitated the retaining of some horses on the farm or the purchase of a motor truck which is used only a small portion of the year. On a large farm, the maintenance of a truck which is used for only a small proportion of the year, does not result in a serious overhead expense. However it becomes almost prohibitive on a small farm where the income from crops is not sufficiently large to carry a non-paying investment. It has been the aim of many truck and tractor manufacturers to overcome this difficulty on a small farm by devising a vehicle for both farming and road haulage work.

To John K. Gumpfer, of Decatur, Illinois, has fallen the distinction of designing and producing one of the first of these new all-purpose farm vehicles of the future. The apparatus is shown in the accompanying illustrations. It follows automotive practice in its design and is a four-wheeled, short wheelbase vehicle with a truck type engine, clutch, gearset and enclosed and dustproof type of final drive to the rear wheels. All four wheels are permanently equipped with rubber tires to prevent damage to roads when it is used as a highway vehicle. When thus employed, the load it moves is carried in one or more four-wheeled trailers at a fair rate of speed.

The conversion from a road vehicle to a farm tractor is made quickly and inexpensively by slipping larger metal-tired wheels directly over the rubber tires, the tires remaining permanently in place. Both front and rear tractor wheels are held to the steel disk truck wheels by bolts through special lugs cast just inside the peripheries of the disks. By a wide range in the gear set ratios, appropriate tractor and truck speeds may be gained at will by moving the gear-shift lever which is located in the cab, as is done on automobiles and trucks. The rear axle is provided with a power take-off and pulley shaft for all forms of farm work.



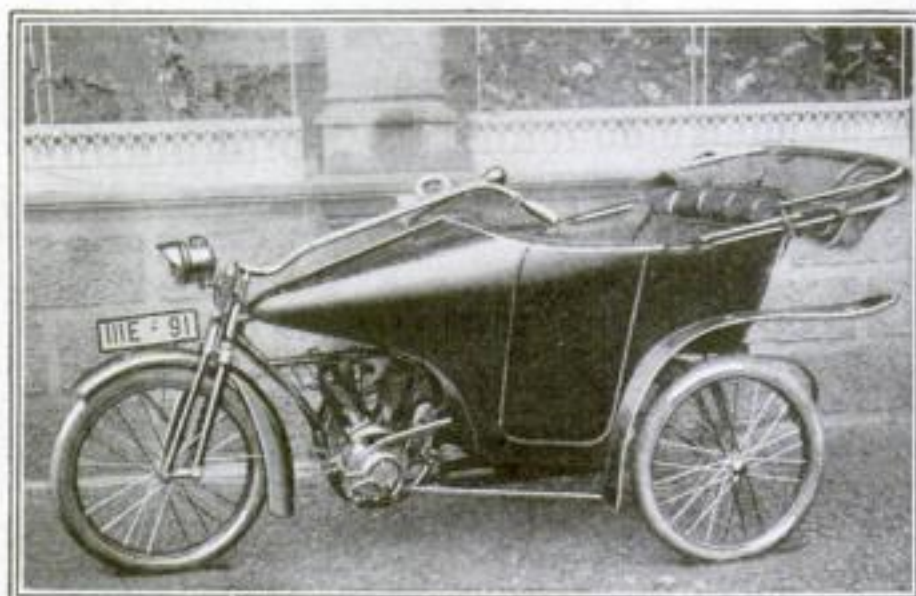
When employed as a truck the farm tractor hauls one or more four-wheeled trailers at a fair rate of speed



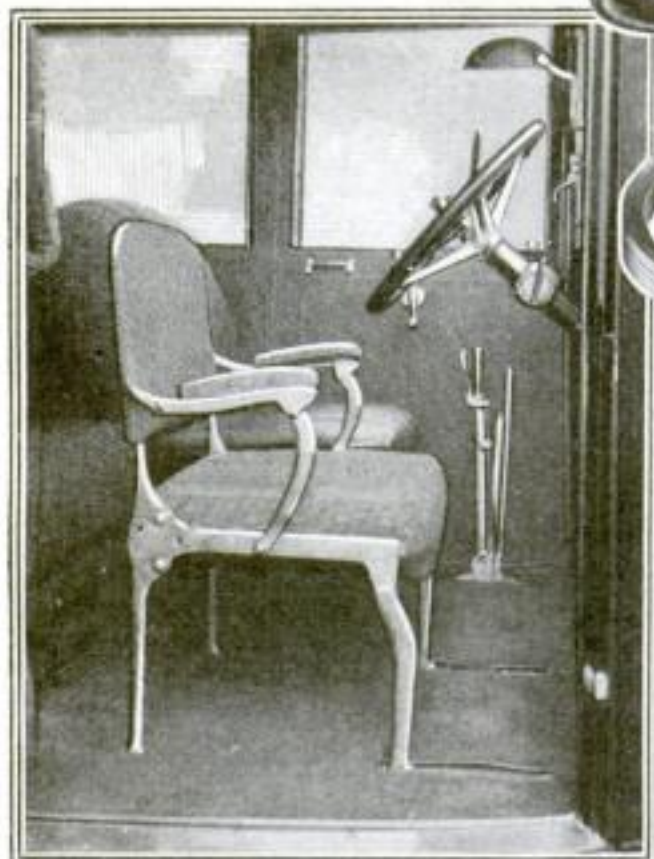
# Giving the Automobilst a Novelties that are interesting



A license-plate holder will be a boon to the motorist whose plates rattle and who is continually losing nuts and bolts



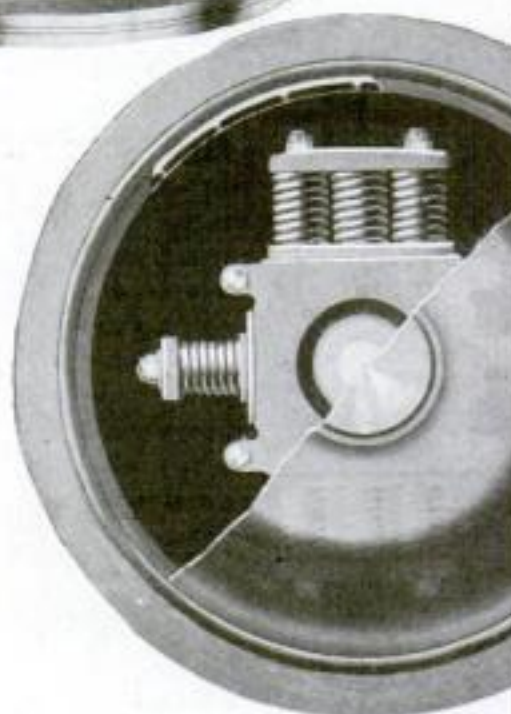
A motorcycle engine behind the front wheel moves this complete little car



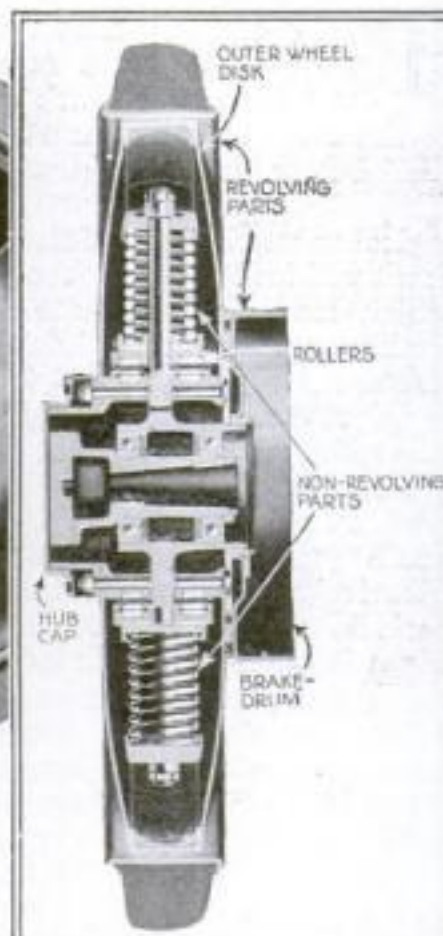
Collapsible parlor chairs for the sedan body can be folded down when not in use



This three-piece piston ring, with each ring square cut, and a heavy ring to take the strains, uses the other two snap rings to prevent leakage of either gasoline or oil



A motor-truck wheel to make trucks on solid tires ride easier and use less gasoline. The stationary springs are inside



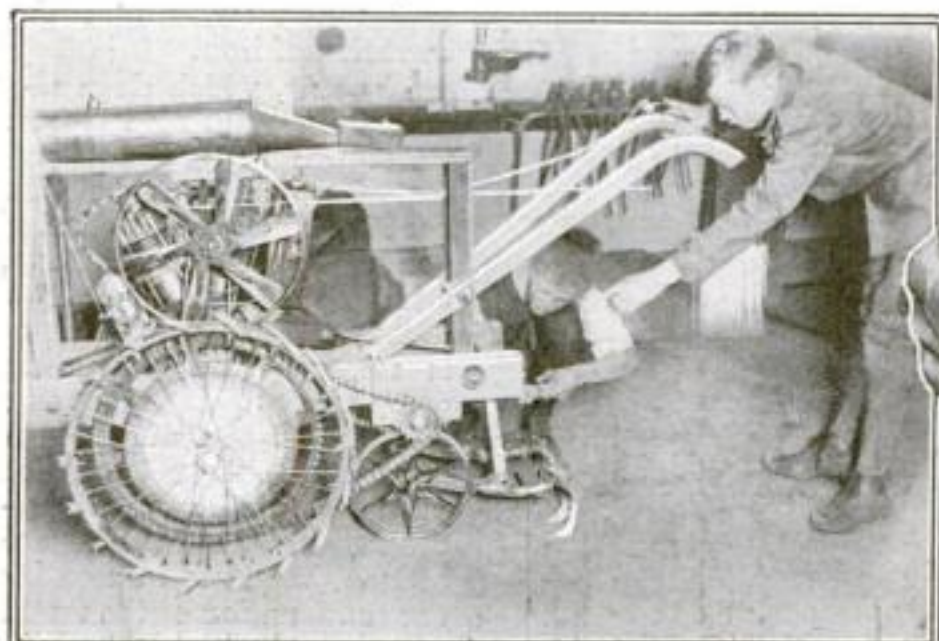
Three lawn-mowers can be attached to your tractor to cut a wide swath of grass



This tractor is pulling down with a steel cable the walls of a burned-out three-story building

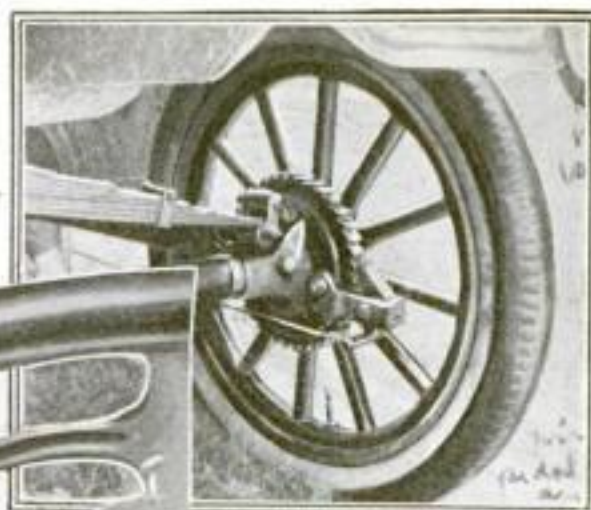


# Helping Hand with His Accessories because they are new and attractive



Some boys who wanted to save garden labor saw a motorcycle wreck, obtained the crushed machine, and made a tractor from it

HORN PUSH-BUTTON  
ATTACHED TO THROTTLE LEVER

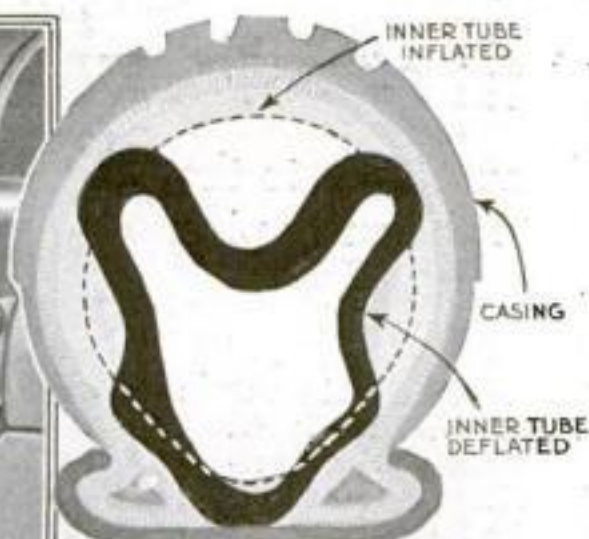


When a car is left on a hill it cannot be started downhill if it is fitted with the ratchet attachment that is shown above

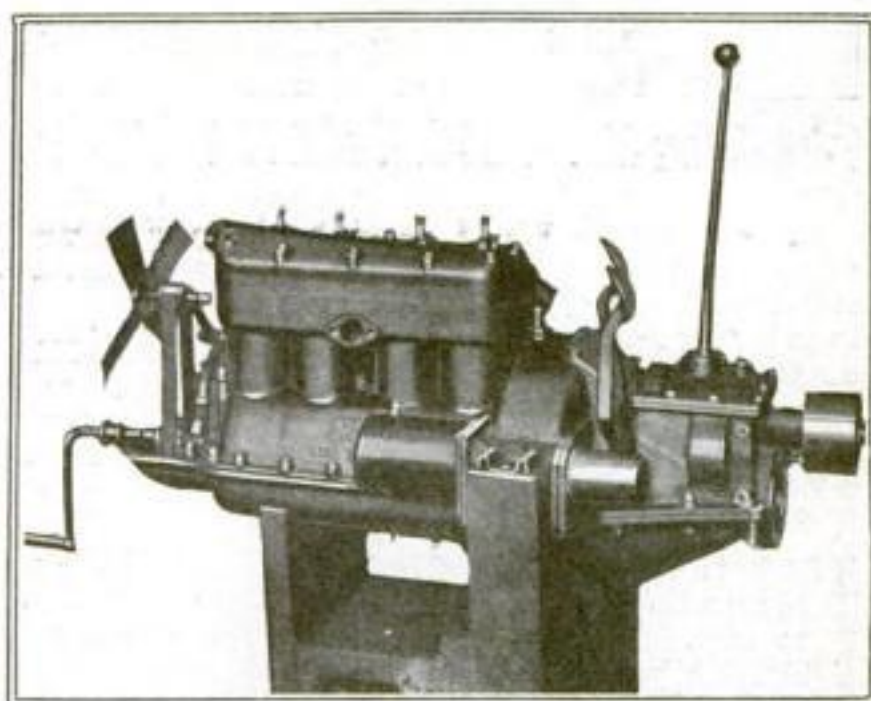
With the push button shown at the left the horn may be blown without removing either hand from the wheel



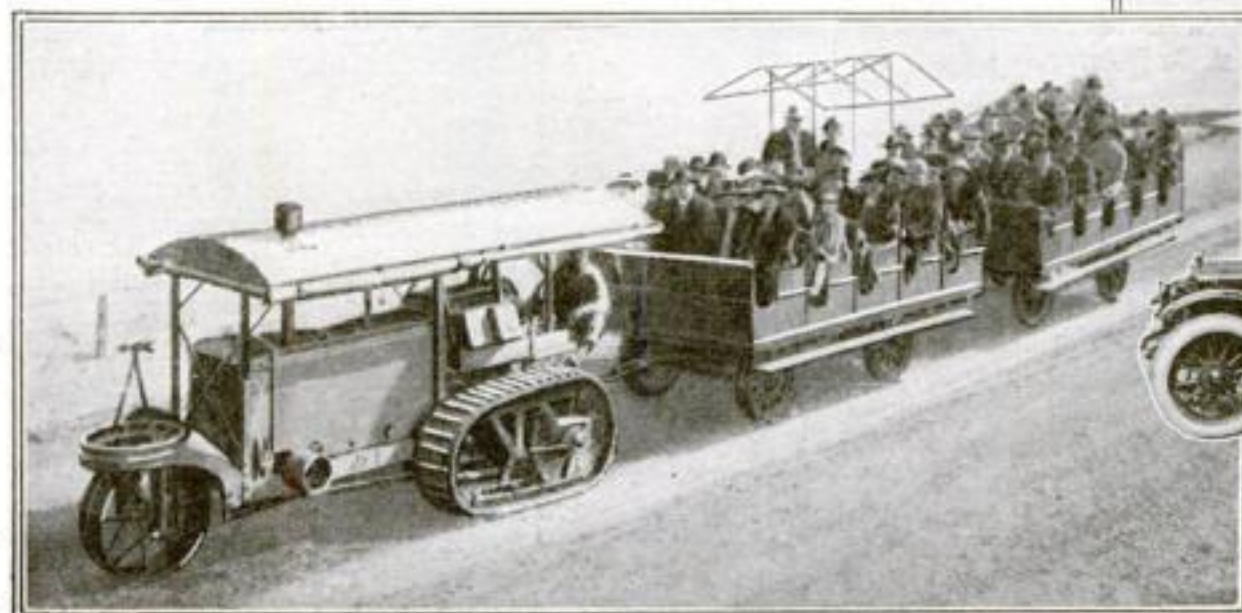
These grease-cups have a screw cover that keeps out the fine dust of a sanding machine. They compress and lubricate bearings until they are ready to be refilled



This inner tube will not deflate if punctured. It is more resilient than the ordinary type for the compressed rubber tread is an added cushion between the air and the road



The very latest in attachments for Fords is a three-speed sliding transmission such as those used on the big cars. The new unit is mounted on the engine, eliminating trouble with the bands of the planetary system

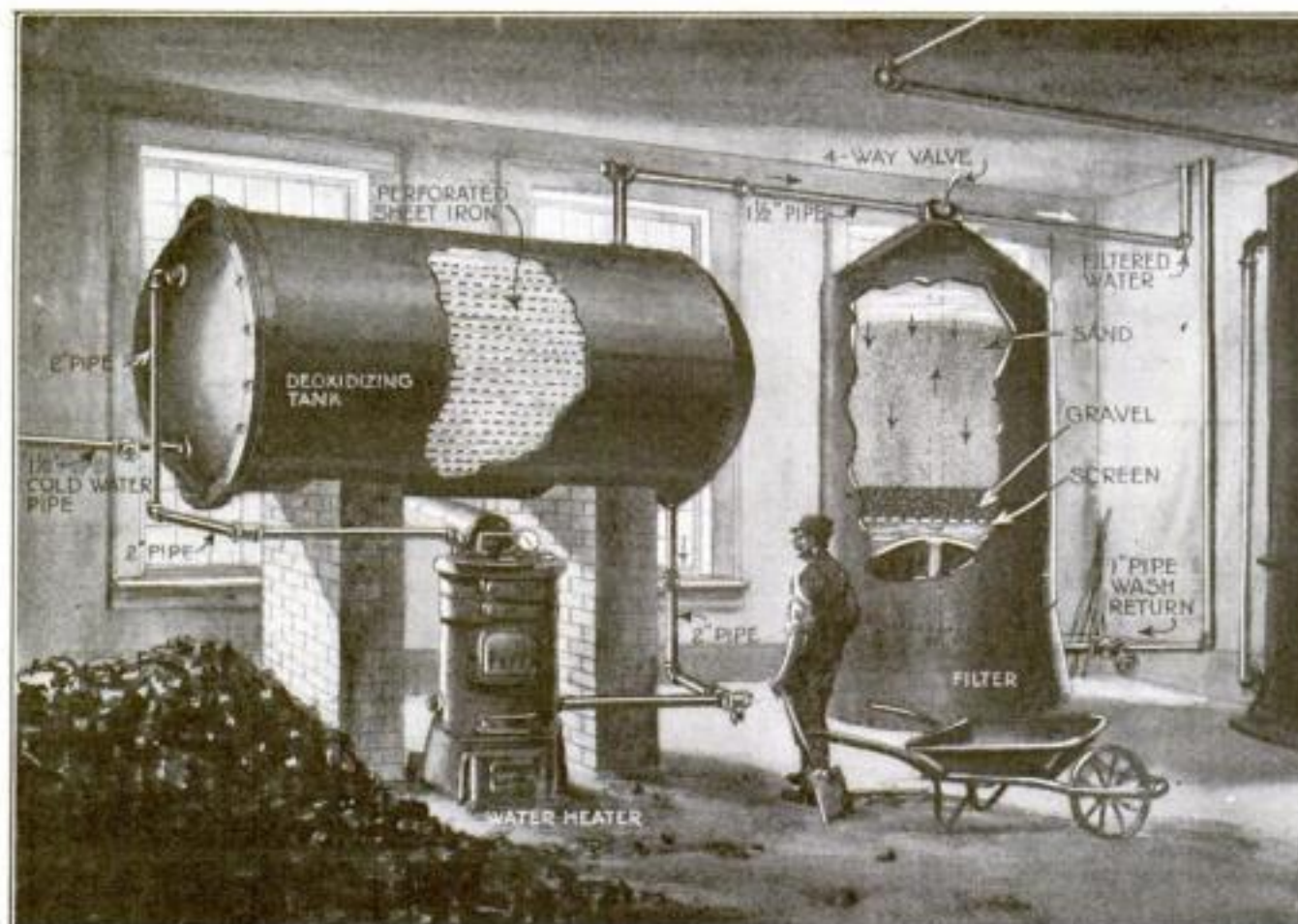


Visitors to Catalina Island have to be hauled up and down its steep slopes with a caterpillar tractor which trails two passenger trucks



This truck disseminates good-health propaganda. The roof is used as an open-air picture-theater, and the screen is transparent so that the audience can view pictures from both rear and front





The water is robbed of its free oxygen by perforated iron plates in the deoxidizing tank. The rust is filtered out before the water is piped to the tenants

## Why Does Iron Rust?

The answer will solve a question of importance to the house-owner who may easily eliminate the rusty pipe

By Ernest Welleck

**I**RON is the metal most important to man because it is the most useful to him. Without it our modern civilization would have been impossible. Its strength and durability are proverbial. Yet, it is not an ideal utilitarian material. It deteriorates rapidly by rusting unless well protected.

Protected? Against what? Against influences which cause the iron to corrode. If we wish to protect the iron we must first ascertain the identity of these influences which constitute its enemy, and become acquainted with their methods of attack.

Experience has taught that the rusting of iron is caused by the joint action of two chemical agents, air and water. Iron will not rust in air free from moisture, or in water free from air like pure distilled water.

### Distilled Water Solves Problem

If a piece of iron or steel with a clean, bright surface, is placed in spring or well-water, or in water drawn from the faucet of a hydrant, it will soon turn black and dull. If it is left longer in the water, the iron will gradually change its color. Its surface will turn from black to brown and finally to a yellowish red. The change will be greatly accelerated if we take the iron

out of the water and expose the wet metal to the air. In a short time it will be coated with a reddish-yellow covering of rust which will continue to extend deeper into the metal until the iron is changed to a crumbly mass of rust.

Why does spring or well water cause iron to rust, while distilled water does not? The water in springs, wells, rivers, and lakes always contains oxygen in solution, usually in the form of carbonic acid. But if such water is thoroughly boiled or distilled, the oxygen is expelled by the heat and the water thereby loses its power to corrode iron.

### Not a Stable Compound

Rust, chemically speaking, is not a stable and uniform compound the composition of which can always be expressed by the same chemical formula. In its first stages it contains but little oxygen. Gradually it draws more oxygen and also some hydrogen from the water or from the atmosphere, forming what the chemists call a hydroxide of iron. Chemists give a highly interesting and complicated explanation of the intricate electrochemical processes involved in the formation of rust. They speak of "dissociation," "ionization," and

"electrolysis," but these terms have no meaning to the average person who is more interested in the problem of preventing rust than in scientific theories concerning causes and reasons of the corrosion of iron.

The rust, which clogs and gradually destroys iron water-pipes in our houses and factories, which eats holes in our kitchen utensils, corrodes our boilers and machinery, and the iron and steel work of our bridges and viaducts, is seldom homogeneous in composition. It is nearly always a mixture of oxides of iron containing variable proportions of oxygen, hydroxide of iron and carbonate of iron, which is formed by the combination of the metal with oxygen and carbon, taken from the carbonic acid dissolved in the water.

### Prevents Corrosion

Modern engineering has devised a simple method of preventing the corrosion of hot-water pipes in dwellings and factories. It is based upon the clearly established fact that iron will not rust in water which does not contain dissolved oxygen. The method is illustrated by the

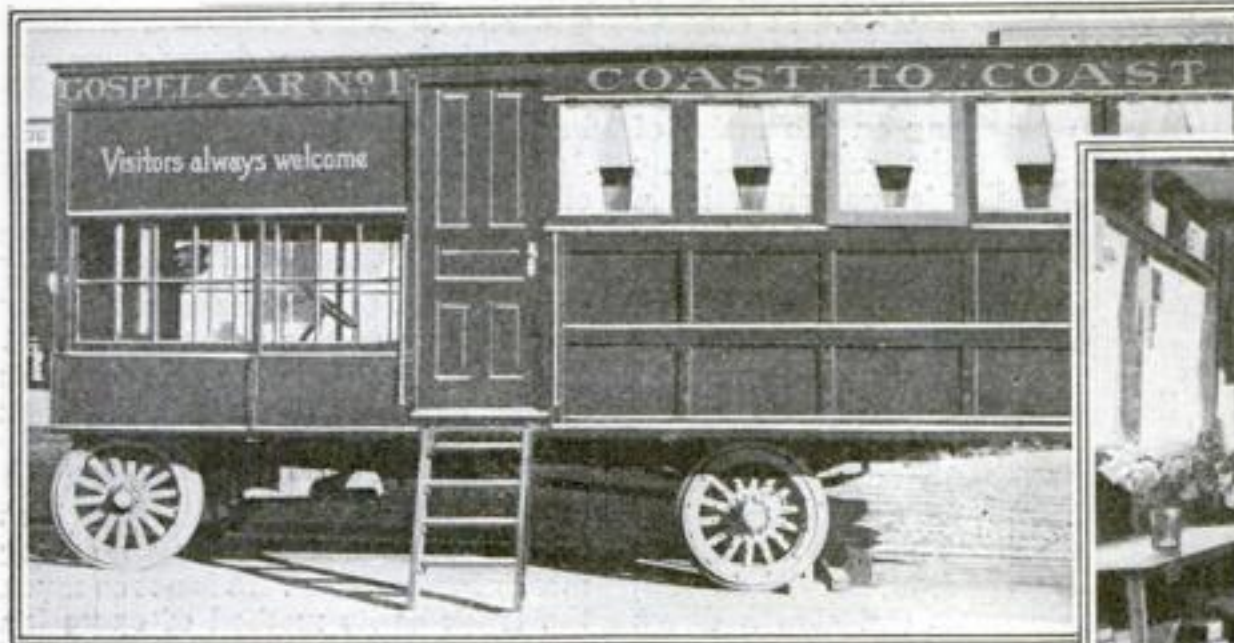
accompanying drawing. The water, derived from the supply system of the city or village, is conducted to a large metal tank, placed horizontally and containing a large number of thin, perforated sheets of a cheap grade of iron. From the lower part of the tank the water passes through the coils of a heater and back to the tank. While the hot water is circulating through the perforations of the iron plates it gives up the oxygen which it contains in solution. Most of the rust formed on the plates adheres to them, the rest is carried by the hot water to a smaller, vertical tank containing a sand filter and is deposited on the filter. The water, free from dissolved oxygen, and therefore no longer able to cause the formation of rust, is distributed to the consumers by a system of service pipes.

The operation and maintenance of the plant require little attention; it is practically automatic in its action. The deoxidizing tank must be opened from time to time and new perforated iron plates must be substituted for those that have corroded.

It is advisable to clean the filter occasionally by reversing the flow of water through the sand, or by removing the rust-stained layers of the filter and adding fresh, clean sand of the same fineness to take their place.



# Carrying the Gospel by Motor



The modern preacher doesn't wait for his flock to come to him. He seeks it in the gospel wagon which is his home as well



**M**OST preachers move from one place to another frequently, but the pulpits and churches they formerly occupied remain stationary. Not so with the Rev. William Arthur Downer, of Glassboro, N. J., traveling evangelist, who is on a coast-to-coast journey in a specially designed vehicle which includes features of a home and house of worship.

Equipped with conveniences for cooking, sleeping and eating, as well as a piano and Biblical literature, this automobile truck may be described as a "house-on-wheels," or a gospel wagon. The unordained minister and

family of two, together with a traveling companion, enjoy all the comforts of a home, with the exception of a bath tub. Running water is afforded by a 25-gallon tank. A bed installed at one end of the car is for the preacher and his wife, while a folding cot offers facility for restful sleep for the two daughters.

While working as an automobile mechanic, the parson conceived the plan of building a home on an automobile truck chassis. The body of the car, 7 feet 10 inches wide by 22 feet long, is constructed of oak. The

interior of the home of this itinerant preacher is adorned with printed Bible texts. Conspicuous on the exterior is this inscription, "Visitors always welcome." To carry the gospel to the wayward and to the "down-and-out" fraternity is the twofold object of this tour.

## If You Could Look Inside a Tractor

**I**F you could cut a modern farm tractor down the center with a huge knife, as the housewife halves a grapefruit for breakfast, just what would be revealed is shown in the accompanying illustration. More than anything else, this view shows the influence that the automobile has had on the development of the modern farm tractor. Beginning at the right, you discover first, an automobile or motor truck type of gasoline engine, with its speed regulated to a set number of revolutions by means of an automatic sealed governor, such as is employed on motor trucks. If you look closely, you will see that the engine is of the valve-in-the-head type and all enclosed.

Then again, in the pipe between the top tank of the radiator and the top of the engine cylinder block, there is a small nest of copper disks which expand and contract to shut off the circulation of the cooling water through the radiator, so that the engine temperature is always kept at that point at which the low grades of present-day gasoline burn with greatest efficiency. Then the cylinder head is removable, so that the interior of the cylinders and the pistons may be examined without tearing the whole engine apart.

Following the engine crankshaft farther to the left, you see an automobile type of clutch and the driving gears to the rear wheels, all the power-transmitting parts being completely enclosed in an oil bath. This makes for little power loss through good lubrication, and prevents the dust, always stirred up in plowing work, from getting into any of the finely-machined parts. Dust would have the same effect on the tractor mechanism as in the movement of a watch.

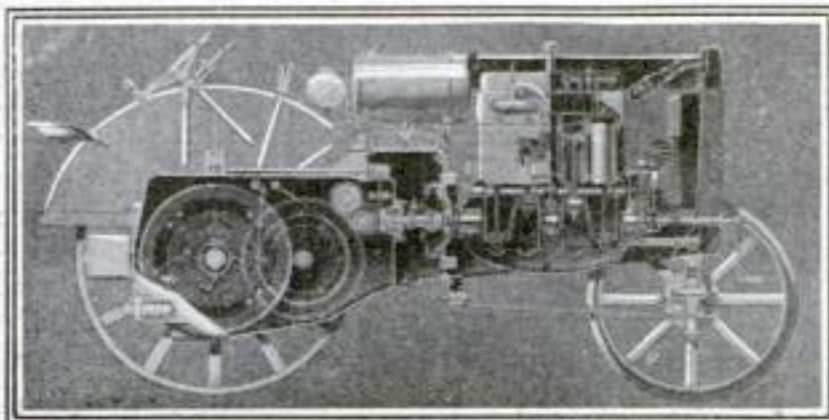


Turning the crank pulls toggle arms of the jack together and raises the car

## A Jointed Jack

**F**ROM far away Cook Islands, within the boundaries of New Zealand, comes the ingenious automobile invention of Henri D. Ray, of Avarura, Island of Rarotunga. It is a jack for elevating the axle of an automobile and consists of a base and head to which toggle-joint arms are pivotally connected. Extending through or between jointed portions of the toggle-joint levers is a screw which terminates in a crank-handle. Stops or collars on the screw make it possible to fasten the jack in any desired position.

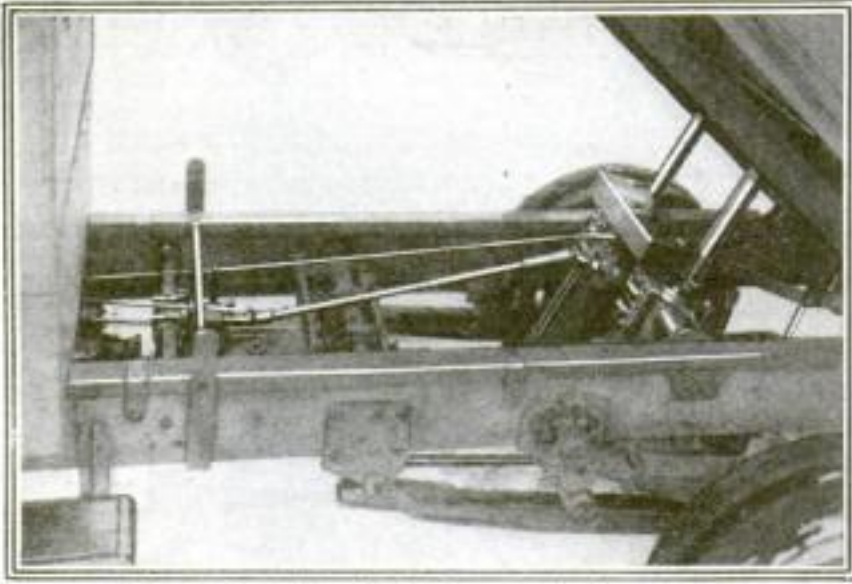
The pivotal connection of base and head to the toggle-levers makes the device admirably flexible to adjust to the level of any surface.



A half-slice of a farm tractor reveals the simplicity of its mechanism which is far less complicated than that of an automobile



# A Hydraulic Hoist for the Motor-Truck Body



The hydraulic hoist is fast coming into prominence in the automotive field. This one operates with power from the propeller shaft

shackle. It consists of a vertical cylinder or cylinders, depending on the make of the truck, containing pistons driven by a gear pump. The power to drive the pump is taken from the front propeller shaft or from the amidship transmission and is applied by operating a lever in the driver's seat. The hoist is swung from saddles so that it can give a direct lift on the body at all times. The oil is

stroke. To lower the hoist a valve operated from the driver's seat is opened, which allows the oil to by-pass back into the head of the cylinder. As the piston stands on a solid head of oil, which oil must be displaced by passing through this valve, the body can come down at only one rate of speed. This is an important safety feature in hydraulic automatic hoists. Thus, it is possible for one to work around or under the body of a truck equipped with a hoist and be perfectly safe.

When the wheels of a truck are not turning it is not making or saving money for its owner. It is not so much the truck as its method of operation upon which the success of any kind of truck transportation depends.

**A** NEW hydraulic motor-truck hoist has recently made its appearance. It is mounted on the chassis frame in front of the rear axle about in line with the front hanger, or rear spring

driven through oil ways to the bottom of the cylinders, thus forcing the pistons up. The hoist automatically stops when it reaches its full

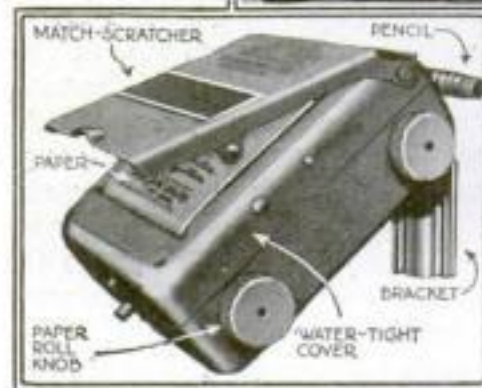
## Jot It Down on the Pad

**O**NE of the latest convenience-giving accessories for the motor vehicle is a memorandum pad enclosed in a small case which can be attached to the panel instrument board or to the steering column directly beneath the wheel. The device is intended for the motorist who desires to jot down his appointments, gasoline and tire records, touring incidents, and the like and for the truck driver to record names and addresses of deliveries to make, or calls for packages; witnesses to accidents, or other operating items.

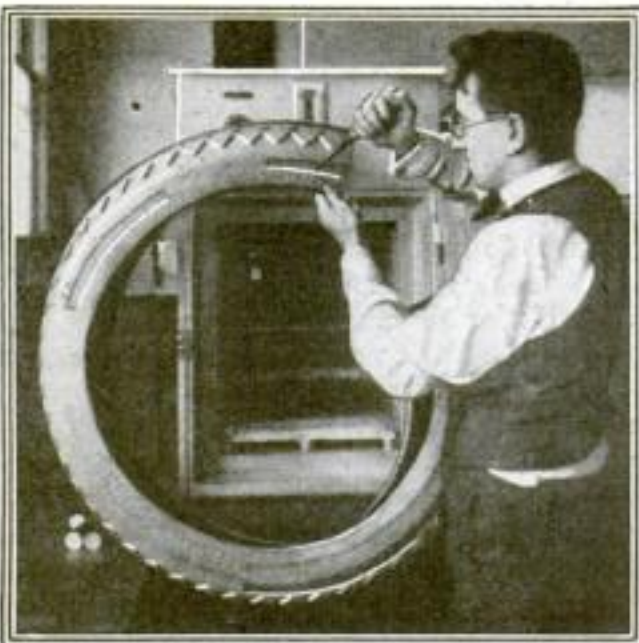
The case of the instrument is made of aluminum and is provided with a watertight cover to prevent water from getting on the paper. A match-scratcher is placed on the outside of the cover as an added convenience. A

clip for a pencil is provided at the top of the case. The paper is wound around two rolls across a writing surface. The winding is done by knurled knobs at one end of each roll.

Jot down things as you think of them, and give the upper knurled knob a turn to roll the paper back and leave a clear sheet. To refer to memoranda, turn the lower knob and unroll your writing.



Why stop and hunt for the account book in your door compartment? Jot it down on the pad attached to the steering



The Bureau of Standards plugs samples of rubber from various brands of tires to analyze them and determine their durability

## Analyzing the Pneumatic Tire

**T**HE scientist in this photograph may ultimately be able to enhance the purchasing power of the dollar when you buy automobile supplies—not by equalizing the law of supply and demand but through a scientific contribution of a method to determine raw materials with physical and chemical properties of most durable qualities for making tires.

The photograph illustrates how the U. S. Bureau of Standards is plugging samples of rubber from various brands of automobile tires for the purpose of analyzing their physical and chemical properties. Specimens taken from the tires are subjected to what is scientific-

ally described as an accelerated aging test. Conditions in this government laboratory aim to duplicate in a brief period—within the course of a week or two—the age of a tire analogous to that of several years on public highways or under normal conditions.

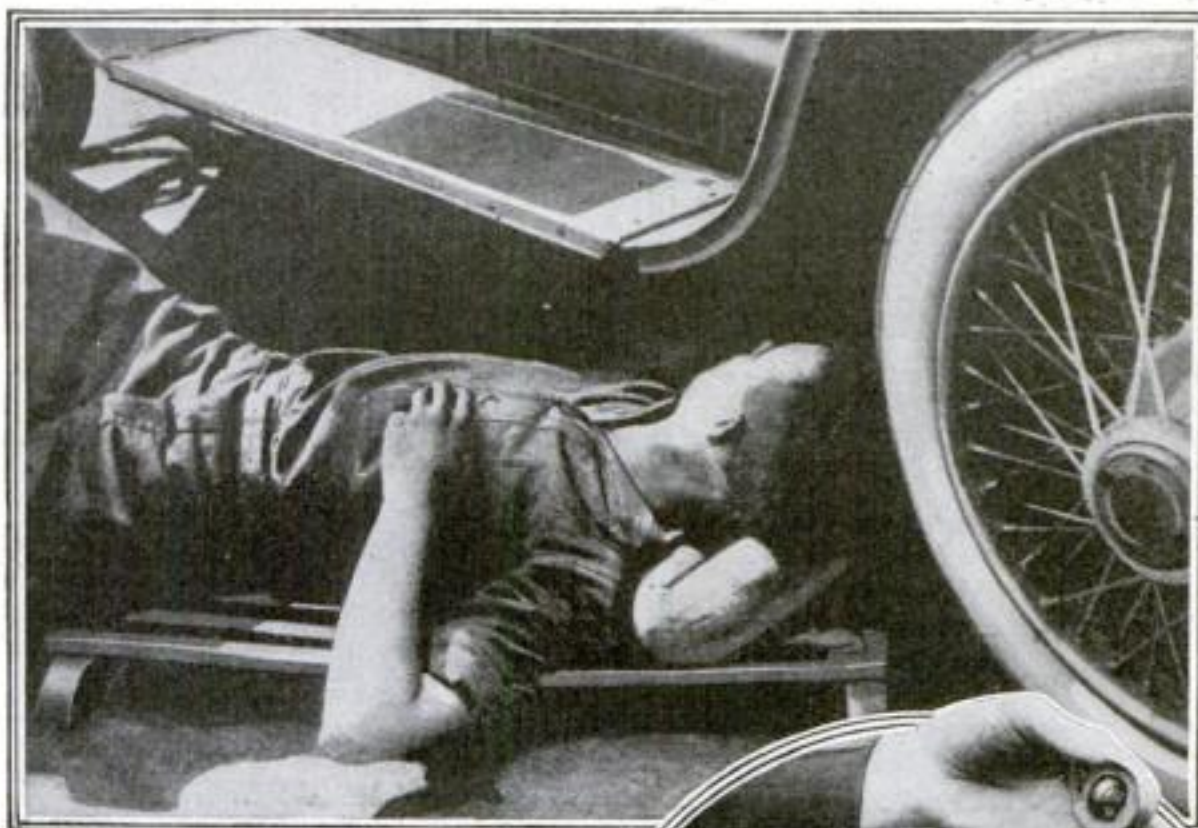
During a year the Rubber Section of the Bureau of Standards analyzed for the War Department more than 500 samples of rubber, representing 250,000 tires, and having a valuation of \$20,000,000. For example, assistance was extended a manufacturer of solid-rubber tires in improving the adhesion between the tread stock and the hard-rubber base. Also the quality of the compounds was enhanced and valuable information was deducted.



# Making Your Motor Upkeep Less Expensive

You need not be a mechanic to know certain useful facts

By Fred Gilman Jopp



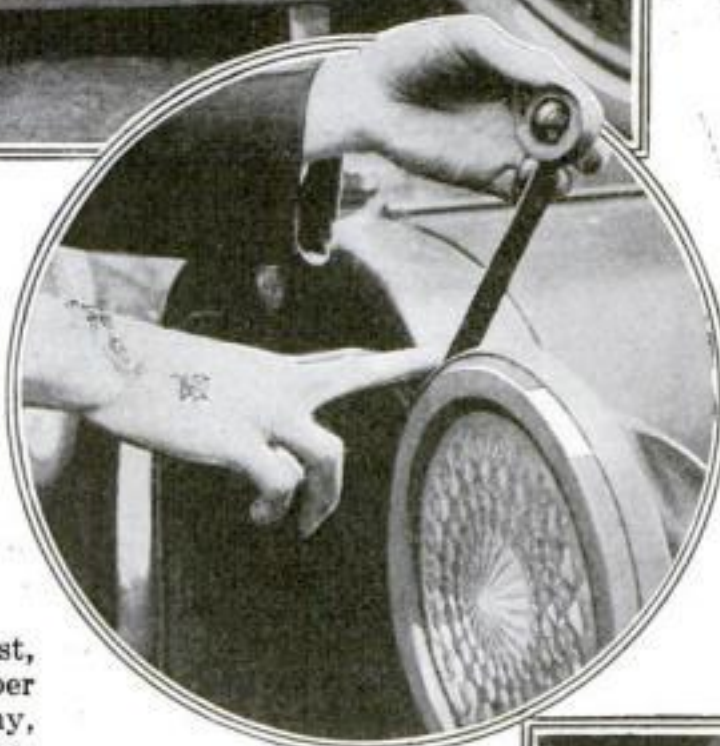
An inner tube as a cushion for the repair-creeper makes working under the car less of a strain

WHETHER it pays you to use an automobile or not, depends altogether upon how your car is treated, and the motorist who realizes this fact is the one that gets the best results. After several months' use—a fairly severe test of any piece of mechanism—the average automobile begins to deteriorate fast, unless it has been given the proper attention; and this is the reason why, in many instances, expensive automobiles are discarded after being in service only a comparatively short time.

It is pathetic but true, that for each motorist who really knows his car in its numerous details, there are thousands who are ignorant of everything save the control. Out of the bitterness of his own experience, the writer offers you this advice: Learn to anticipate trouble by careful reasoning and a thorough study of your individual car.

Economize in gasoline and thereby cut the running cost of the entire car. See that the carburetor is properly adjusted. Lubricate all the running parts properly and keep the tires inflated. See that the brakes do not drag and that the wheels and bearings are adjusted neither too tight nor too loose. Be careful how you run the car; don't try to climb hills without shifting to second speed, or even to first, on a very steep hill. It is the little things that make for automobile economy.

A fellow who doesn't know the trick, will take about twice as long to pump up a tire with a hand-pump as will the



Mechanic's tape wound around the lamp rim and given a quick turn removes the stubborn rim

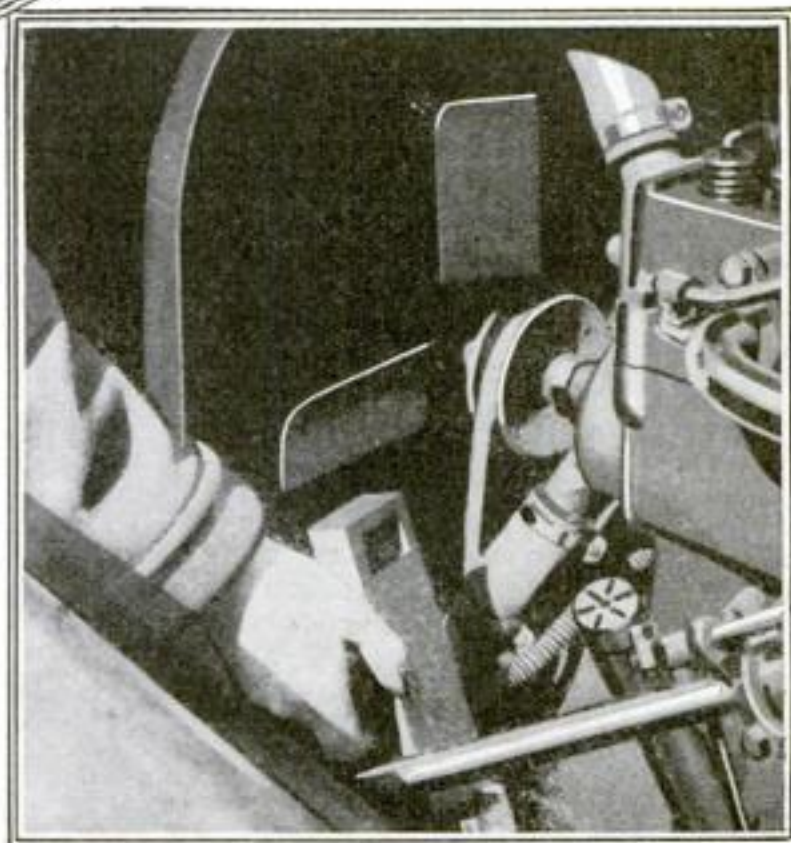
chap who knows how. Short, jerky strokes that bring the pump-plunger only part of the way up the barrel are the kind which quickly tire you; and besides, such strokes take much more time to fill the tire with air. Pull the plunger slowly all the way up; then force it down again just as slowly. By so doing you get the benefit of the full volume of air in the pump-cylinder and you eliminate that tired feeling which accompanies the short, jerky stroke.

A well known rubber company attaches to every shipment of brake-lining a card containing some excellent suggestions. These will be useful

to all motorists who desire to keep their cars in good condition.

1. Storage battery inspected every two weeks.
2. Grease-cups turned up every 1,000 mi.
3. Springs oiled every week.
4. Oil and gasoline connections inspected every week.
5. Crank-case drained and washed out with kerosene every 500 mi.
6. Universal joints packed with grease every 1,000 mi.
7. Differential and transmission packed with grease or oil every 1,000 mi.
8. Spark-plugs cleaned every 1,000 mi.
9. Carbon removed from cylinders twice a year.
10. Valves ground every 5,000 mi.
11. New piston-rings every 18 months.
12. Wheels alined once a month.
13. Water in circulation every time car is started.
14. Wheel bearings inspected monthly.
15. Carburetor cleaned monthly.
16. Self-starter inspected monthly.
17. Steering-wheels and knuckles inspected weekly.
18. Brakes tested and equalized monthly.

Don't be a "clutch rider"—a fellow who keeps his foot continually on the clutch. On some cars clutch riding



Elusive things, such as bolts and nuts, when they drop into the drip-pan may be found by means of a toy periscope to which is attached a little flashlight



will invariably burn out the thrust-bearing, because of the mechanical construction. The weight of the foot has a tendency to release the spring tension and make the clutch slip. Slipping is a waste of power, and promotes friction which wears away the contact surfaces, at the same time adding to the slipping propensity. Keep your left foot on the floor boards and practise so that you can raise it automatically to the clutch when necessary.

Removing the wheels is usually a hard job, but if you know how, it is as easy to do as anything else about the car. Tie a piece of rope to either side of the wheel, leaving enough room to insert a jack between the rope and the end of the spindle. Place the foot of the jack against the rope, and the head against the end of the axle; then slowly work the jack so that a pulling force is put on the wheel through the rope. This method is one that should be remembered, for it will remove the tightest wheel.

Make sure that the spark-plugs fit tight and that they are provided with good copper asbestos gaskets. If the spark-plug porcelain is cracked, it will allow the compression to escape. Inspect the pet-cocks or priming-cups and see that they are all tight and that they stay closed all the time.

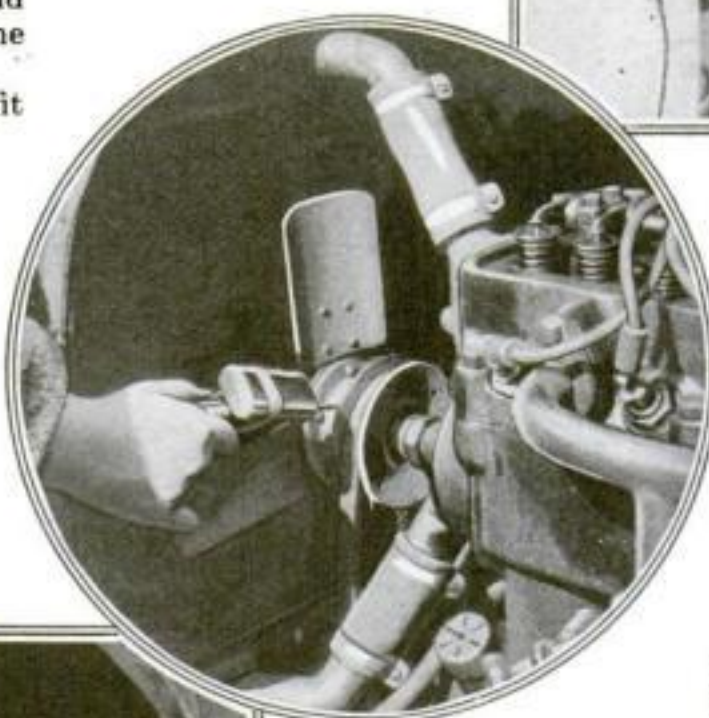
The piston-rings may have turned so that the openings are all in line, or you may be using such a light oil that the engine does not get a tight compression seal. Oil,

when heated, is very thin. In some cases patented piston-rings will help eliminate the leakage, but if the cylinder is worn oval, there is no remedy except that of reboring it. Kerosene will free the rings of carbon, but it is best to use it only when you are ready to drain off the old crankcase oil.

Special care should be taken with the connections in the lamps and at other points. A short-circuit occurs when two wires of opposite polarity are in metallic contact. Under such conditions the storage battery will be discharging and there will be no lights at the



Did some near-mechanic ever monkey with your perfectly adjusted carburetor? Put sealing wax on the adjusting screws



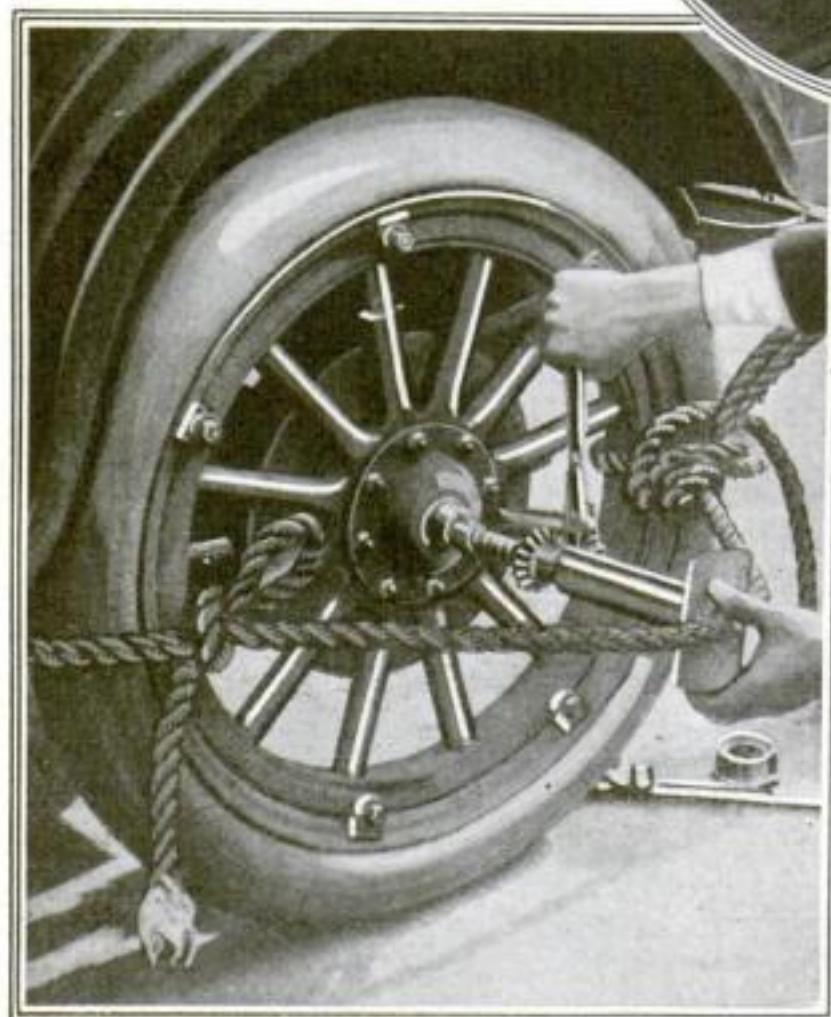
For the dark a flashlight held to your screwdriver by adhesive

from carbon, and the valves clean, and to be sure that the timing of the valves and tappet adjustment are as set down in the instruction book which accompanies your car.

A graphite preparation in the oil, in suitable proportions, will make a very perceptible improvement in the compression of an automobile engine, and this will be more apparent on an old car. It will also increase the oil economy and keep the engine in better running condition. When an engine, regularly cleaned with kerosene, lubricated as described, and with valves ground regularly, shows a serious loss of power, the lack of compression may be traced to the piston-rings. The cause thus narrows down to plain wear, granted of course that other possible causes, such as wear of the valve stems, push rods, etc., are eliminated.

One reason for loss of compression lies in the use of that boon of the present-day motorist, the self-starter. The man who cranked his engine by hand knew the "feel" of the compression.

Few owners are aware of the value of soap for sealing leaky joints in the gasoline system. Often gasoline oozes out around the filler-cap, especially when the tank is nearly full. The gasoline then spreads over the outside of the tank, collects dust, and impairs the finish. A coating of ordinary soap on the gasket and threads will prevent leakage. When joints develop small leaks, a coating of soap will usually close them.

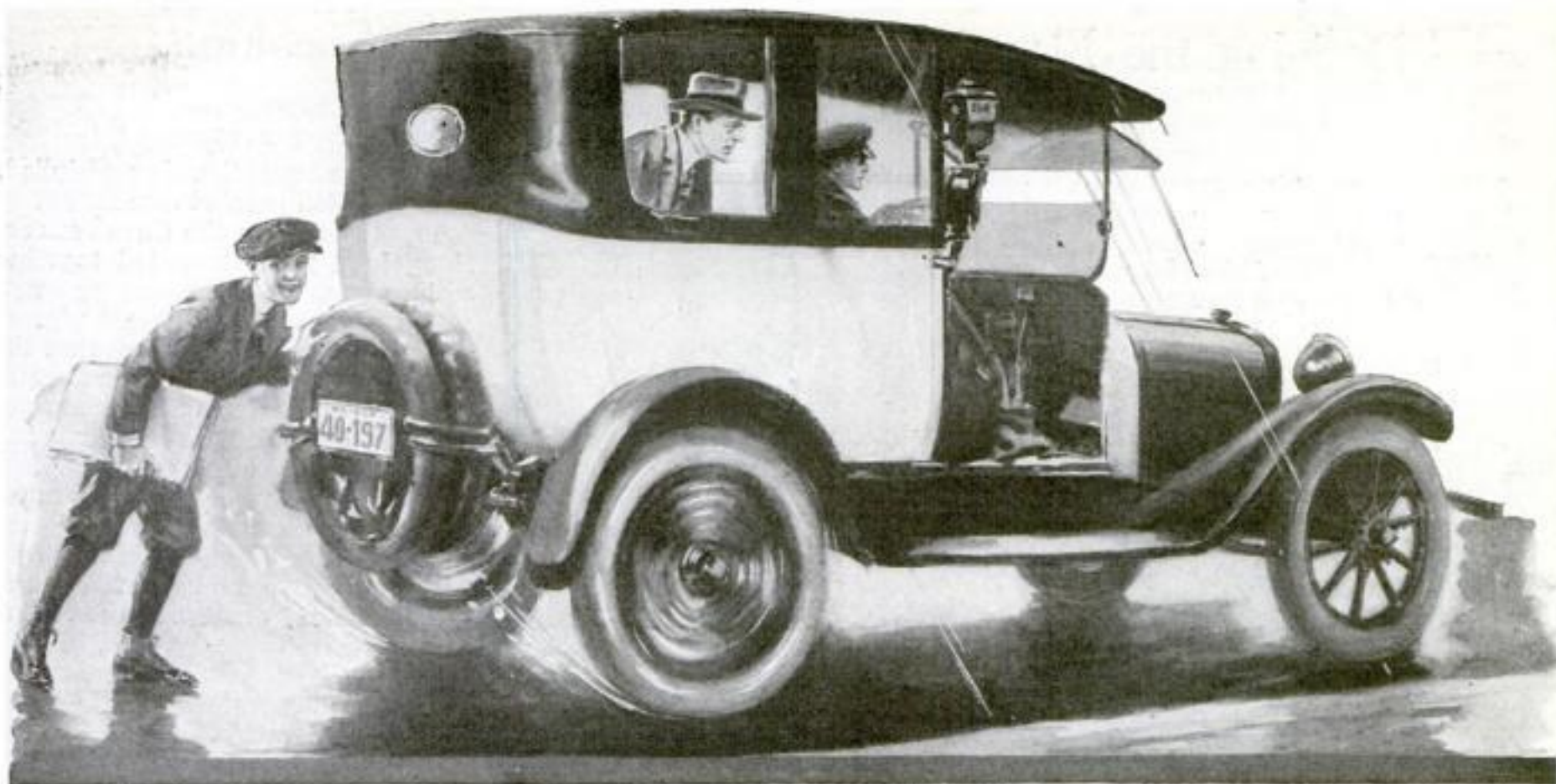


If the jack is worked against the hub of the wheel and a rope is tied around it, the stubborn member will soon come off the axle. This idea sometimes will save hours of work

lamps. A short-circuit may occur at any point in the wiring system, but is usually found at terminals that have been carelessly made, or at places where the wire-insulation is worn.

During compression the valves should be closed tightly. A broken spring or faulty adjustment will prevent their closing and will result in no compression at all. In the case of incorrect timing the trouble will be noticeable as a lack of power in all the cylinders. Carbon under the valves will prevent them from seating. The remedy for these difficulties is to keep the engine free





## Plenty of Power but no Traction— spinning wheels that get nowhere

*—and the man in the taxi believes he is paying for the futile spinning of the wheels. The meter on his car back home would register them in miles.*

He believes the taximeter is registering a charge against him for the useless spinning of the rear wheels and the resulting damage to the tires.

A valuable object lesson, if it makes him think of his own car and how he abuses his own tires when he fails to put on

## Weed Tire Chains

*For Sure and Certain Traction*

The taxicab companies protect the Public and themselves from skidding accidents—from excessive costs. *Taxicab wheels spin only when drivers disobey the companies' order to "Put on Tire Chains when streets are wet or slippery."* And to safeguard their patrons against the drivers' possible negligence, the taximeter is attached to front wheels.

Weed Tire Chains, when used judiciously, *lengthen the life of tires.* Whether they are used on taxicabs or on pleasure cars, Weed Tire Chains materially *reduce operating expenses.*

Nothing looks more ridiculous than a spinning tire—nothing more brainlessly extravagant. Put on Weed Tire Chains "at the first drop of rain."



### AMERICAN CHAIN COMPANY, Inc.

BRIDGEPORT  CONNECTICUT

In Canada: DOMINION CHAIN COMPANY, Limited, Niagara Falls, Ontario  
**Largest Chain Manufacturers in the World**

*The Complete Chain Line—All Types, All Sizes, All Finishes—From Plumbers' Safety Chain to Ships' Anchor Chain*

General Sales Office: Grand Central Terminal, New York City

District Sales Offices:

Boston

Chicago

Philadelphia

Pittsburg

Portland, Ore.

San Francisco





# Defining the Electric Current—Hydraulically Speaking

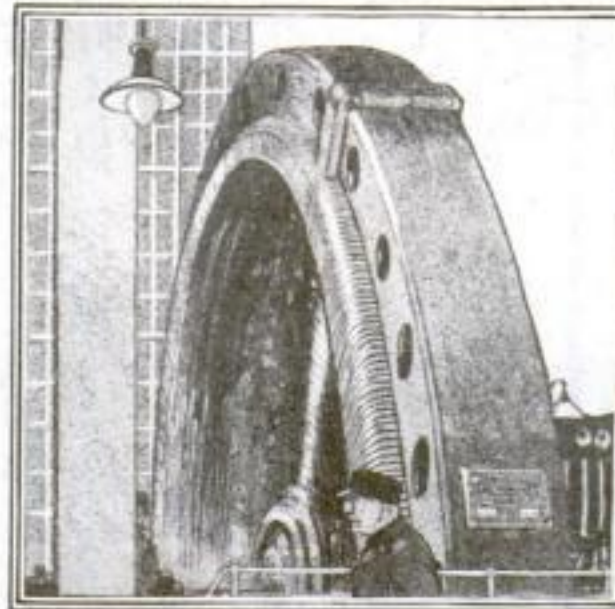
By L. B. Robbins

WHEN you think of volts, think of pounds. When you think of amperes, think of quarts. When you think of ohms, think of the resistance offered to the flow of a liquid by the diameter and length of the iron pipe through which it flows. When you think of watts, think of the power resultant upon the combined efforts of these three.

The electrical terms in every-day use are simple to the electrician, but they invariably try the brain of the layman, so this hydraulic analogy is used, and appears to be the easiest means of initiating one into the world of electrical nomenclature.

Look at Fig. 1. A coffee-can filled with water will create a pressure of about 4 oz. when the water is forced out of a pipe in the bottom. The reason for this is the hydraulic law that water elevated 1 ft. will create a pressure of  $\frac{1}{2}$  lb., or 8 oz. Therefore a coffee-can, being 6 in. high, will show half that pressure, or 4 oz. So much for the hydraulic end of the argument.

An ordinary dry-cell discharges electricity at about  $1\frac{1}{2}$  volts. This word "volt" is an electrical term for pressure, used just as pound is used to designate pressure when speaking of water. So, the electrical current contained in the dry-cell is sent out through the wire at a pressure of  $1\frac{1}{2}$  volts just as the water was discharged from the can at 4 oz. pressure. These two units,  $1\frac{1}{2}$  volts and 4 oz., will stand as measurements in the illustrations to follow.



Do you know the meaning of electrical terms? No? Then read this article which simplifies them for you

Now, with the volt clear, what is an ampere? Roughly speaking, an ampere represents quantity; that is, the amount of electricity that was discharged at a pressure of  $1\frac{1}{2}$  volts.

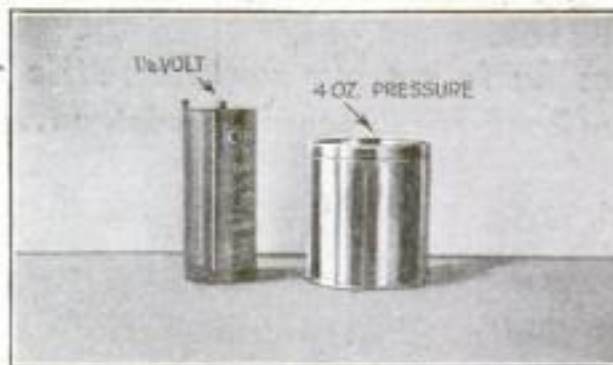
Reducing this to simplified terms, let us say that the coffee-can held 1 qt. of water. A dry-cell contains about 30 amperes. The former was discharg-

output, or quantity, is multiplied. This is called parallel connection.

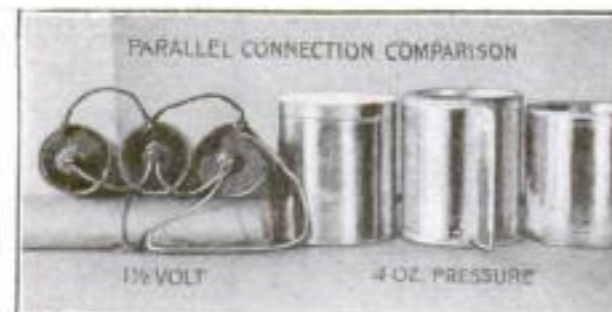
Try to imagine the three cans set along in a row, connected together with pipes, and discharging their contents through a vertical pipe as before. You will readily see that the vertical pressure remains the same as if the contents were discharged from one can, since 6 in. is the maximum height of any one of the cans. But there will be three times as much water discharged from the three as there would be from the one. That is, 3 qts. of water will be discharged at 4-oz. pressure, whereas in the case of one can there was only 1 qt. In the same way, batteries can be connected up to discharge the contents of the combined number of cells at a pressure of only one. This is done by connecting in parallel, or by connecting all of one terminal together, all of the opposite ones together, and then connecting those wires to form the circuit. This is known as parallel connection.

Then again, there are times when a high amperage is desired, together with a high voltage. This is effected by what is known as the "series multiple" connection—Fig. 5. As will be seen two or more cells are connected in series. Then a like number are connected in series and arranged beside the first. After a sufficient number of these sets are arranged they are connected with

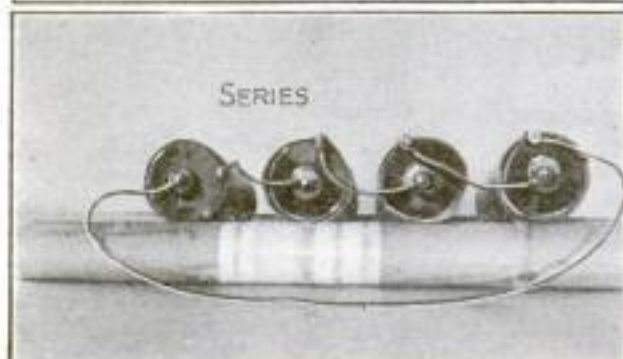
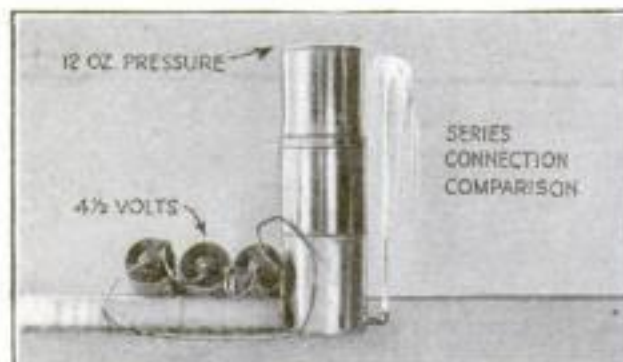
one another in parallel. Then, by connecting those sets in parallel, we get the voltage represented by each set, with the sum of the amperage contained in all the cells, just as was shown in Fig. 4. Instead of trying to im-



A coffee-can filled with water will create a pressure of about 4 oz.



This is called parallel connections, which means that output or quantity of current is multiplied



Figs. 2 and 3 illustrate how a water column 18 in. high instead of 6 in. will make 12 oz. instead of 4 oz.

ed at 4-oz. pressure, while the latter was discharged at  $1\frac{1}{2}$  volts pressure.

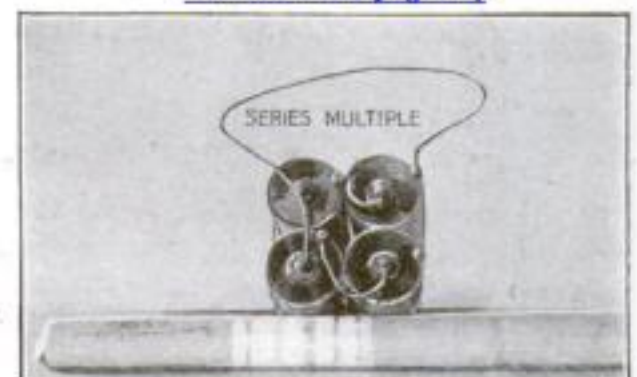
Now, supposing you wish to produce a water-pressure of 12

oz., what shall you do? Just build up a column of water 18 in. high instead of 6 in. high, and you will get 12-oz. pressure instead of 4-oz. To accomplish this result, you must, of course, imagine that the bottoms of the two upper cans have been removed so that the water in the three cans has become one column. This rule holds true with three batteries when connected in "series," as shown in Figs. 2 and 3. By connecting the positive terminal of one cell with the negative terminal of the next, and connecting the remaining opposite terminals together, the electrical pressure is increased to three times what it was before.

But there is another way of connecting batteries—that shown in Fig. 4. By this method the pressure is kept to that of a single cell, but the

agine this, just imagine that two columns, each containing three cans, were placed side by side and then connected together, discharging through one pipe. Instead of getting only 3 quarts of water, we should then get 6, thus doubling the quantity at 12-ounce pressure.

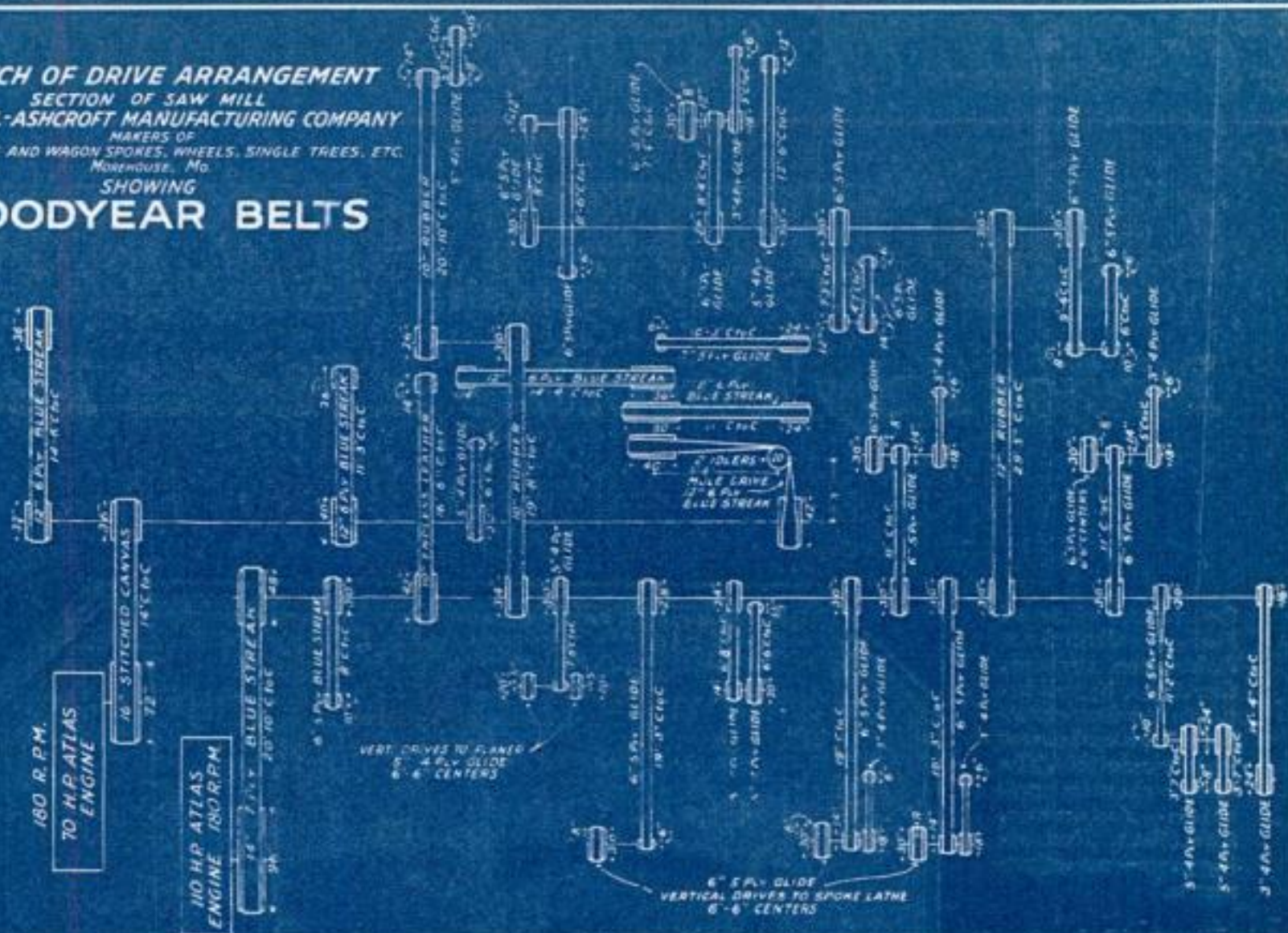
(Continued on page 94)



When high amperage is desired together with a high voltage, the batteries are connected in multiple series



SKETCH OF DRIVE ARRANGEMENT  
SECTION OF SAW MILL  
THE BIMEL-ASHCROFT MANUFACTURING COMPANY  
MAKERS OF  
AUTOMOBILE AND WAGON SPOKES, WHEELS, SINGLE TREES, ETC.  
MOREHOUSE, MO.  
SHOWING  
**GOODYEAR BELTS**



Copyright 1920, by The Goodyear Tire & Rubber Co.

## An Order, Two Plants—and the G.T.M.

**The first time the G. T. M.**—Goodyear Technical Man—talked with this Company that today has two plants practically standardized on Goodyear Belts he virtually declined an order. He had an opportunity to sell a belt of the same dimensions as the one which had just worn out after a short term of unsatisfactory service. Instead, he demonstrated the value of an expert study of belting quality and working conditions.

**The Bimel-Ashcroft Manufacturing Company** had been having costly trouble with a 14-inch, 5-ply belt on the main drive in their Morehouse, Mo., plant. Time after time they had had to cut it because it stretched. Every cut meant a shut-down of the main drive, involving heavy loss of production. When, finally, the stretch was eliminated, the rawhide lacings began to break, the lacing holes pulled out, and the belt began to open at the plies. So they decided to get a new belt, and told the G. T. M. to send on a 14-inch, 5-ply belt.

"Let me recommend a 14-inch, 7-ply Goodyear Blue Streak," said the G. T. M. "Your drive calls for a stronger belt than you have been using. Among the drive factors affecting the belt is a starting load 50% heavier than the running load." He went on to show how his analysis included every factor of power, pulley dimensions, and general service conditions. His recommendation finally was accepted on the strength of what he showed he had learned about that drive.

**The Goodyear Blue Streak's success** not only put an end to the main drive troubles but opened the way for analyses of the entire plants of the Bimel-Ashcroft Company at both Morehouse and Poplar Bluff. Today, two and a half years after the G. T. M.'s study of that one drive, 82 of the hundred belts in the Morehouse mill are Goodyear, and so are 50% of those in the plant at Poplar Bluff. As fast as any other kind of belt gives up a job, a Goodyear Belt takes its place.

**In the racking service** of the high speed saws and lathes, Goodyear Glide Belts serve the tools; on the heavier drives of the bolting saws and the heading saws, Goodyear Blue Streak Belts withstand the severe duty with an in built strength. These belts vary in length and width and plies and type of construction, but they are uniform in the quality that repays their slightly greater first cost with an ultimate operating economy. They deliver full power, hold the pulleys in a friction-surface grip, hold at the plies and wear both evenly and long.

**The G. T. M. is at your service.** If his recommendations prove valuable to you, our return will be increased, as it has been in this instance, by your satisfaction. For further information about the G. T. M.'s method, and about the belts which Goodyear builds with the care implied in the command, "Protect our good name," write to The Goodyear Tire & Rubber Company, Akron, Ohio.

BELTING · PACKING HOSE · VALVES  
**GOODYEAR**

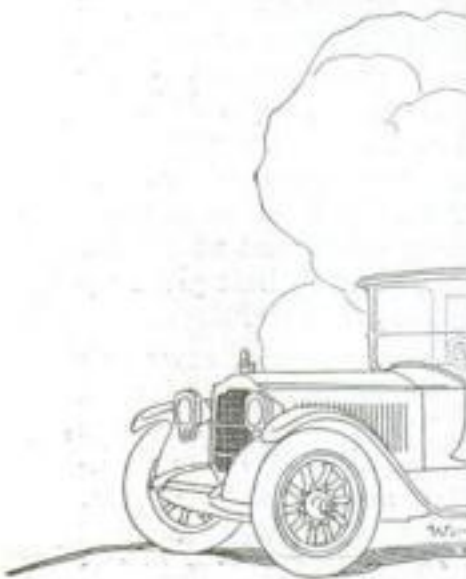
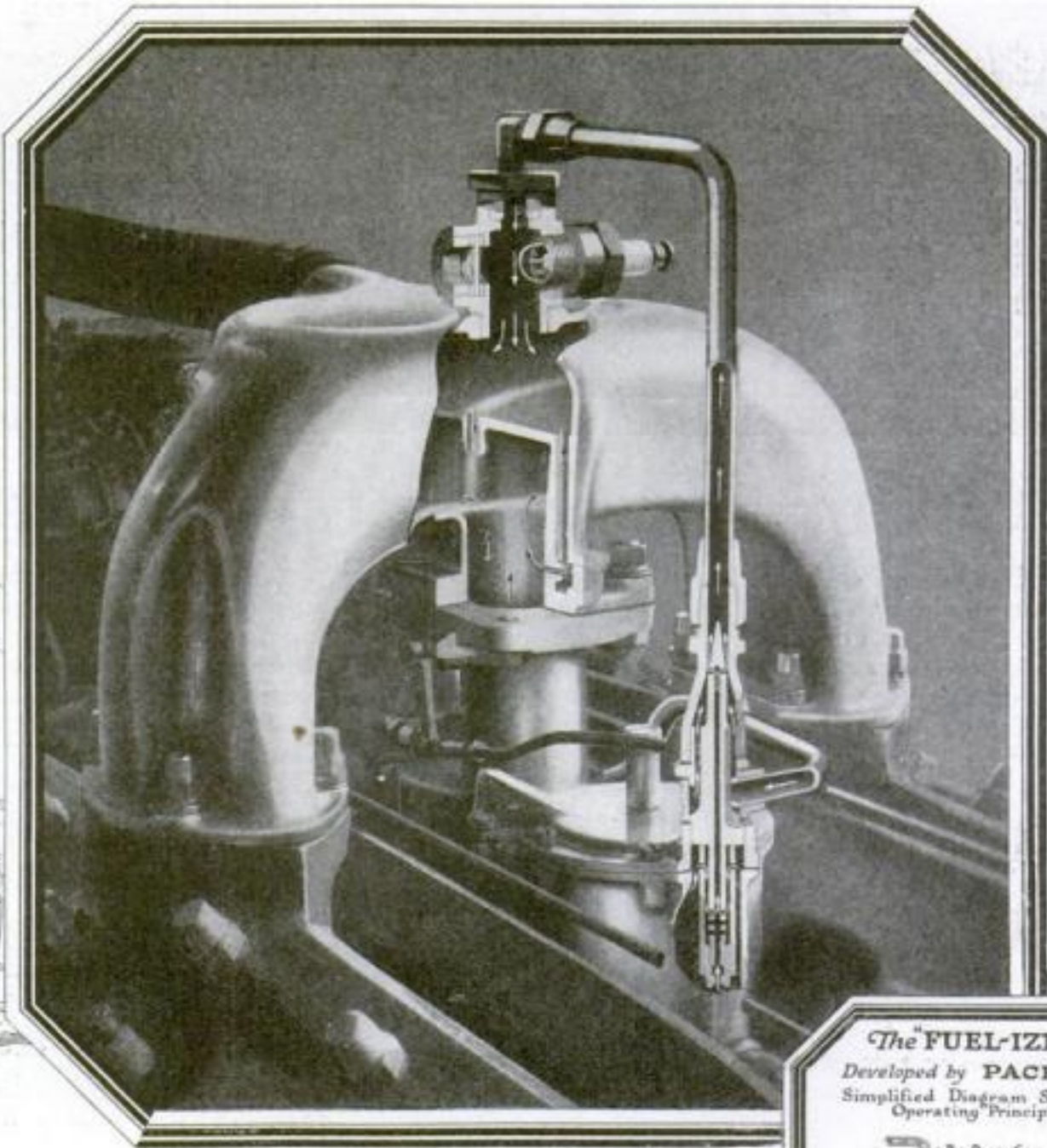


# Packard scores another

## The "FUEL-IZER"

**Makes Any Gasoline a Perfect Fuel**

Sectional view of Fuelizer built into the carburetion system, forming a bypass between the float chamber of the carburetor and the manifold. The arrows show its operation—Automatic, Safe, Silent. No moving parts—no adjustments.



# PACKARD MOTOR CAR



# Engineering Triumph

**This Marvelous Achievement Standard Equipment on every new Packard Car - Simple, Positive, Automatic - Gives Packard owners Freedom from Carbon troubles, Spark Plug fouling, Cold Weather Starting troubles - and Protects Oil from dangerous dilution.**



Part of cylinder head—motor without Fuelizer. The best designed motors known show such carbonizing in a few thousand miles.



Part of cylinder head. Motor equipped with Fuelizer. Mirror surface of cylinder head unchanged after 5000 miles.



Motor completely packed with snow. Temperature of air was 11° above zero. Seldom is a motor in actual service so thoroughly chilled.



Motor started instantaneously. The Fuelizer rapidly thawed its way through snow. Perfect response to throttle attained in 10 seconds.

**W**ITH the development and perfecting of the "Fuelizer"—Packard Engineering again demonstrates its faculty for going to the heart of a problem and getting practical results.

The Fuelizer achieves perfect combustion of all grades of gasoline.

It makes starting as quick and sure in winter as in summer.

It makes available the power in any grade fuel more quickly.

It does away with carbon fouling of combustion chamber, crankcase, valves and spark-plugs.

It does away with the dilution of lubricating oil in the crankcase—removing the main cause of premature wear on engine bearings and scoring of cylinder walls, and preventing sticky valve guides and valve stems.

\* \* \*

Small wonder that the Fuelizer proved the sensation of the recent annual meeting of the Society of Automotive Engineers!

Every motor engineer had known for years that the proper application of heat will break up "wet" mixture.

How to apply the heat has always been the problem—now solved by the Fuelizer.

The Packard Fuelizer not only applies the right degree of heat at the right place—

But the more important still—it applies the heat at the right time—when the engine is cold at starting; and maintains an ideal heat—not overheat—under all running conditions.

\* \* \*

These illustrations tell, better than many words, how the Fuelizer does its wonderful work.

A small part of the mixture is drawn into the Fuelizer and exploded into hot gas by the spark-plug.

This hot gas is drawn down through the Fuelizer heating manifold into the "wet" mixture in the main manifold. It heats up and breaks the "wet" mixture into a dry vapor, which explodes completely in the cylinders.

No time lost in "warming up"!

The Fuelizer has raised the manifold temperature from 33 to an ideal temperature (120° or over) in less than forty-three seconds—2° a second!

Tests made last winter at 5° below zero showed that the engine is able to pull on high gear almost immediately.

During the months of testing after the perfecting of the Fuelizer, not one single case developed of foul spark-plug or valve, combustion chamber wall or piston rings. Nor was there any dilution of oil.

Winter or Summer, the Fuelizer revolutionizes motoring—reducing repair bills—lengthening the useful life of a motor.

A Packard achievement, Exclusively Packard—now standard equipment with every new Packard Car.

In every way a development worthy of the long-established Packard tradition of practical transportation service to the owner of a Packard Car.



Oil tests without Fuelizer showed lubricating oil diluted with over 7 ounces deposits of kerosene in 4 hours of idling. With Fuelizer, no dilution.



Left—Valve from Fuelizer-equipped motor after 6200 miles. Right—Typical carbonized valve from motor without Fuelizer. Note burning of metal.



Any Car without Fuelizer, if started after idling, exhausts mist of unburned gasoline and wasted oil.



Packard Car with Fuelizer starts instantaneously. Invisible exhaust after idling or when starting indicates perfect combustion.

"Ask the Man  Who Owns One"

## COMPANY, Detroit, Mich., U.S.A.



WRITE FOR SAMPLES

L. C. CHASE &amp; CO. BOSTON

NEW YORK - DETROIT - SAN FRANCISCO - CHICAGO

CHASE

Leather

THE UPHOLSTERY OF QUALITY

MADE BY SANFORD MILLS, SANFORD, MAINE.

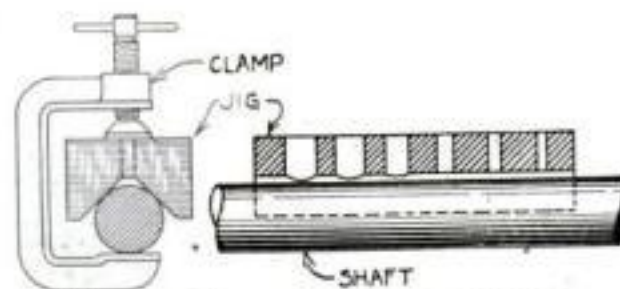
While the foregoing illustrations furnish rough comparisons, it must be remembered that even in the case of water there is always a resistance offered to the water in motion, which would cut down the resulting pressure at the outlet. Elbows, stop-cocks, and internal resistance due to friction, all tend to cut down the theoretical pressure. So, in the case of electricity, the wires and elements through which the current flows tend to lower the pressure or voltage. This resistance can be measured in units called ohms, and is different for every substance through which the current is forced.

Then, just as the working pressure of the water is less at the outlet than at the supply, so the working ability of electricity depends upon the quantity discharged, multiplied by the pressure, with the resistance subtracted. This amount is expressed in watts, the resulting unit of electrical power.

Of course, there are many and varied applications of these electrical terms, due to complicated outside forces; but their analogy to the measurement of hydraulic power is close enough for the instruction of the layman and should make his understanding much easier.

### A Jig for Drilling Round Stock Accurately

WHEN drilling the smaller sizes of round tubing and rod, it is a difficult matter to attain a high degree of accuracy, on account of the tendency of the drill to slip a bit to the side when it is being started. This tendency is apparent even when the rod or tubing is held in V-blocks and clamps on the drill-press table, and an accurate and deep center-punch mark has been made. Even then the drill



The way to insure accuracy in drilling round stock is to have the drill in line

will spring slightly and the cutting-lips will work a bit out of line. The slight inaccuracy thus caused will be magnified in proportion to the diameter of the material being drilled, and the drill, when it emerges, will be out of center.

The only way to insure accuracy in starting the drill, is to employ some means of holding it in line until it has a good start. The little jig shown in the illustration will do just this, if it is carefully made. It consists of a rectangular block of steel, with holes carefully drilled along its length by the various sizes of drills that it is to accommodate, the holes being exactly





# Champion

## Dependable Spark Plugs

### Factory Equipment on Ford Cars Since 1911

**I**T is quite unnecessary for Ford owners to risk experimenting with spark plugs.

A long time ago, in 1911, the Ford Motor Company chose Champion Spark Plugs as best adapted to the requirements of the Ford car.

The judgment of Ford engineers is summed up in the Ford Motor Company's instruction book as follows:

"There is nothing to be gained by experimenting with different makes of plugs. The make of plugs with which Ford engines are equipped when they leave the factory are best adapted to the requirements of the motor."

*Be sure the name Champion is on the Insulator  
and the World Trade Mark on the Box*



**Champion Spark Plug Company, Toledo, Ohio**

*Champion Spark Plug Company, of Canada, Ltd., Windsor, Ontario*



# Protection—



## "The Best that Money Can Buy"

In every field the name of some one product always stands forth, establishing a standard of quality by which all others are measured.

*In the fire arms field  
that name is COLT*

For more than 80 years—in the uncertain hazards arising from the unrest of a congested city—in isolated country—amid the dangers of peace and the conflict of war—COLT has stood for the uttermost perfection in fire arms.

For simplicity of construction—dependability of action—certainty of results—the product of COLT'S factories is universally acknowledged "the proven best by every test." To be satisfied with less is to deprive yourself of COLT protection—"the best that money can buy."

**COLT'S PATENT FIRE ARMS MFG. CO.**  
HARTFORD, CONN.

Manufacturers of  
Colt's Revolvers Colt's Automatic Pistols  
Colt's (Browning) Colt's (Browning)  
Automatic Machine Guns Automatic Machine  
Rifles

# COLT'S

## FIRE ARMS

central, so as to be in line with the bottom of the V-slot that is milled on the under side. The angle of the V-slot may be 45°, but any other angle will do as well. If the material from which the jig is made will allow it to be hardened, this process will make it very much more serviceable. In use, the drill is run through one of the holes in the jig that is of proper size, and the point of the drill is placed in the center-punch mark on the work. Then the block is clamped tightly in place and drilling is accomplished with accuracy.—J. A. WEAVER.

### Washing Your Car in the Approved Way

**N**O automobile owner should forget that unusual care must be taken in washing a new car during the first few months of use.

The best of varnish requires considerable time to harden, and until that time the finish is easily scratched. Only pure castile soap or non-alkali soaps should be used for the removal of grease. Gasoline is out of the question.

Lukewarm (not warm) water should be used in washing, and accumulations of mud or dust should be carried off by means of a six-inch stream of water from the hose, instead of being rubbed off with a sponge.

After a thorough rinsing, the varnish should be dried by means of a chamois-



The body of an automobile must be carefully washed and cleaned; otherwise it will lose its beautiful finish

skin wrung out continually in clear water. A long straight sweeping movement of the chamois produces better results than a rotary motion.

A soft woolen duster is preferable to a feather-duster for the interior of the car.

Plate-glass windows are best cleaned with soapy water to which a small amount of alcohol has been added. Rinsing may be done in the usual way, the chamois being used to take up the moisture remaining on the car body, first making sure the chamois is free from grit.

Wax polishes have been on the market for a number of years and their application is a simple matter. A piece of clean cheese cloth is used in applying the wax and another to distribute it evenly.—R. L. PRINDLE.





## The shoes men are buying for summer comfort

Many new types for outing and everyday wear

**A**T THE seashore or in the mountains—on the street or at the tennis court—wherever you go this summer you will see Keds.

These light, springy canvas shoes are ideal for work or play in warm weather. Their elastic rubber soles put new life in your step. Their soft, pliable fabric makes them always cool and comfortable.

Keds are just the thing for games or any kind of summer wear. They allow the foot full freedom with just the right support. They always give a perfect grip, whether you are playing a fast set of tennis or standing on the smooth deck of a motor boat. It is because of these features that Keds are so popular for every vacation need.

### Other types of Keds

Besides these standard types Keds are made in many special models for different purposes—high shoes and low shoes, with or without heels, in many weights, shapes, and colors. There are sturdy work shoes, light gymnasium shoes, and heavy reinforced models for hiking and rough service.

Some of the latest models are made just like leather shoes, with regular welt construction soles and firmly boxed toes. This means a more formal, dignified shoe—just the shoe you have needed to wear with your white flannels or Palm Beach suit.

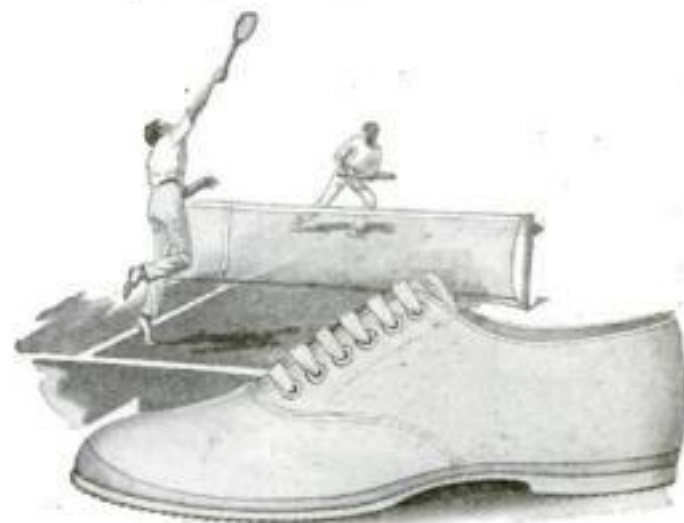
With these additions, Keds are now a complete line of canvas summer shoes—ranging from the easy, less formal tennis shoe to the latest and most fashionable styles of footwear. Last year millions of pairs of Keds were worn by men, women, and children.

Keds are made only by the United States Rubber Company—the oldest and largest rubber organization in the world. You will find them at every good shoe store. Ask to see the various models—notice how wonderfully light, cool and comfortable they are.

Look for the name *Keds* on the sole.

For men and women \$1.50 — \$6.00

For children \$1.15 — \$4.50



*The standard shoes for tennis, boating and vacation wear. Made of light canvas, in high or low models—white or brown—with black, gray, or red rubber soles.*



*One of the smart special models for summer wear. Made of the finest white canvas—in high or Oxford models—with welt construction soles which give all the style of leather shoes.*

# Keds

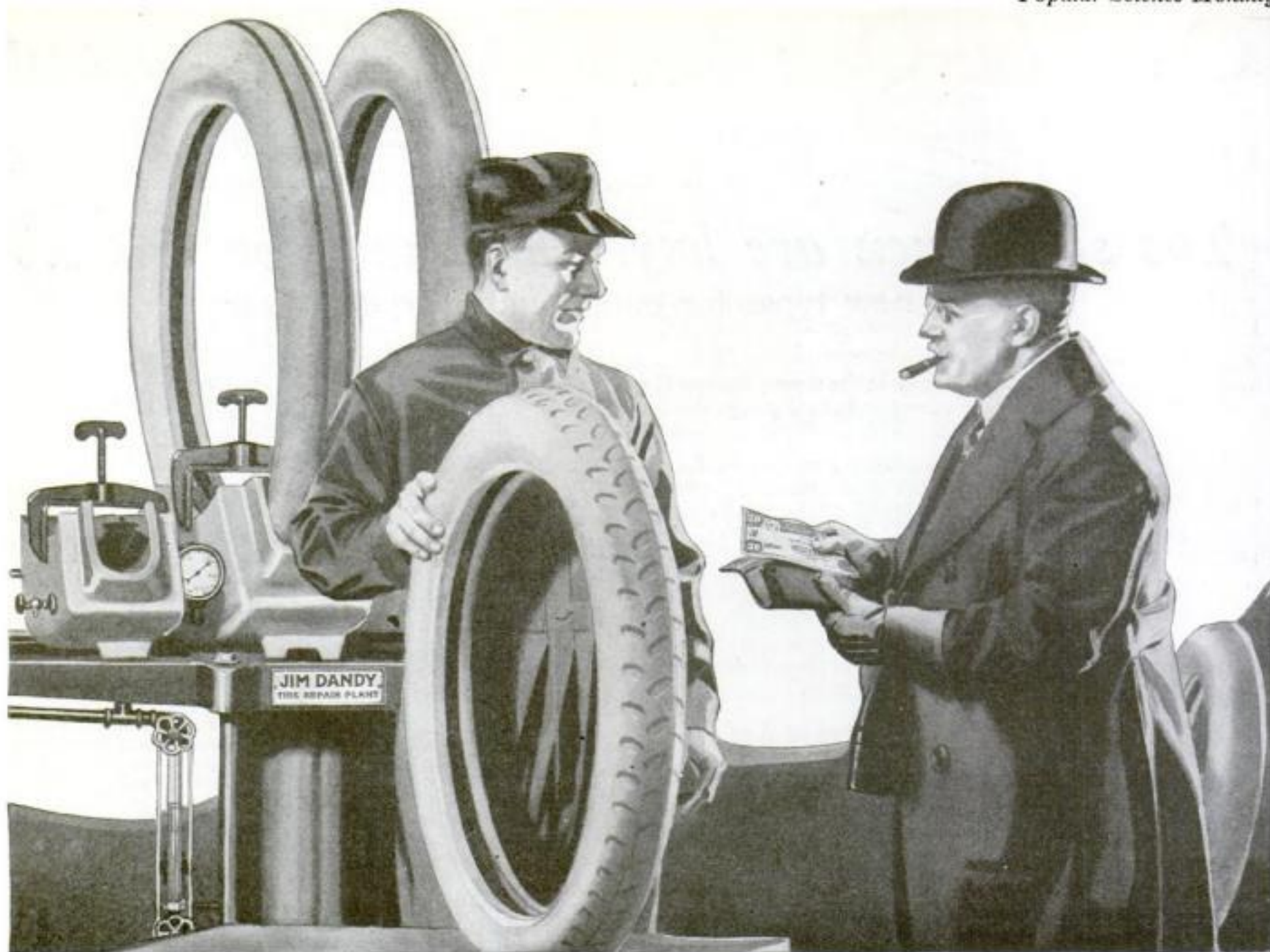


*Sturdy sport shoes—with or without heels. Made of heavy white or brown duck. Brown leather trimmings with ankle patch—red rubber soles and toe cap.*



## United States Rubber Company





# *Make Big Profits Repairing Tires*

**D**O you want more money? Do you want to get into a fast-growing, uncrowded business where you can make from \$250 to \$500 a month the first year? Do you want to be independent? Do you want to share the profits in the richest industry in all America?

Of course, you do. Then investigate the tire repair business—and do it now. The Jim Dandy Tire Repair Plant is making money for many men. It can do it for you.

Fortunes have been made in all lines connected with the automobile industry—but none has ever offered greater opportunity than tire repairing with a Jim Dandy Plant offers you today. The tire repair men of America have a \$200,000,000 business ahead of them this year. Think of it!

By January 1st, 1921, there will be 40,921,076 tires in use in this country. Every one of these tires must be repaired some time. More tire repair shops are needed. Big, profitable business is waiting for them. Do you want it?

## **Business Is Going Begging**

This is your opportunity. The tire repair industry needs business men of ambition and

ability. The field is uncrowded—the number of tires to be repaired is increasing at the rate of 40% a year.

As proprietor of your own tire repair establishment you will be dealing with the wealthiest and most prominent people in your community. These people will ask you for advice about tires, accessories, even automobiles—unlimited opportunities for profit will be yours.

And you will be in a business which is an absolute necessity to the community. Tire repair trade comes again and again. You will have a steady repeat business getting bigger and bigger every year.

## **\$250 to \$500 a Month**

With your own Jim Dandy Tire Repair establishment you can make your income \$250 to \$500 a month or more depending on your energy and initiative. Many tire repair men who have done a business of \$250 the first month have increased to \$500 the third month. What these men have done you can do. They started like you and learned the business. Their success is not unusual.

Get started in tire repairing with a Jim Dandy plant and get started now. There will never be a better time to start.



# Own Your Own Business—Be Independent

**W**HY depend on another man's business to make a substantial income for you?

Why not put your time and ability into your own tire repair business—then you will get all you earn. *You* can be independent just as well as the other men who own Jim Dandy Tire Repair Establishments. These men broke out of the rut, stopped working for somebody else—and started their own tire repair establishments.

## We Teach You FREE

*You* can start a highly profitable business today with a few hundred dollars. One Jim Dandy Plant equips you—we teach you everything about tire repairing—how to start in business—how to get trade—what to charge—how to figure your cash profits. You can learn in one to three weeks—and be ready to make money.

It makes no difference what your present business is. You can make a success of your own tire repair establishment. You don't have to be a mechanic. Neither do you require a college education. Tire repairing is a business man's business. If you have the energy and the will to do, we can teach you in a short time.

We have had forty-one years successful business experience. Since 1879 we have been gathering the information and experience which help you make a quick start today. You understand, of course, that we give you our training and help without charge.

The men who have made big money are the men who have had the foresight and the nerve to break away from the crowd and strike out for themselves when they saw a chance for independence. Don't let a salaried position keep you from *your* chance to own your own business, be your own master, pocket your own profits. Many a "job" has kept a man from a bigger opportunity as an executive in his own business.

## Your Opportunity

Haven't you often felt that *you* could manage the business you are in now, if you had the training and opportunity? Haven't you suggestions and ideas which you know would make bigger profits possible? Give yourself a chance to use these ideas where they will pay *you*.

In your *own* tire repair business *you* will have a chance to do the planning and give the instructions. In a short time you can have more work than you can do alone. Then you will have assistants to do the actual work, while you give your time and thought to the active management.

No previous training—no long apprenticeship—no large investment. You can get started immediately—open a shop—and in a short time you have more work than you can handle alone. Good tire repair men are badly needed. Your profits start the day you set up your Jim Dandy Plant.

There is no city too large or town too small for you to do a profitable tire repair business. To every 11 persons in the United States there is an automobile with four tires to be repaired. No matter where you are—what your age or occupation—in *one month from today* you can be making money from your own tire repair business if you start *now*. Let us prove it.

A Jim Dandy Tire Repair Plant makes it easy for you to learn the business and to turn out the kind of work that brings customers back again and again. It is the only tire repair plant on the market which uses super-heated steam. Perfect work is assured even when you are a beginner. You can make any kind of a repair—and you buy no unnecessary molds or parts. You do not pay for anything that will not bring returns.

The Jim Dandy has the largest capacity of any plant of its size on the market. It is fully guaranteed and backed by our long experience in the tire repair business. We have established tire repair businesses for men of many ages and professions in towns of 200 population and up and have no record of a failure. We are ready to give you every assistance.

## Get The Facts By Return Mail

**Investigate.** Send the coupon below or a letter or postcard. This brings you full information—personal consideration and advice—and a big catalog. Tells all about the tire repair business. How you can make money—be independent.

By return mail you can have all the facts before you. You might as well make \$5000 a year. It is up to you. You know you want it. Then investigate. Use the coupon below.

Scheffer & Rossum Company

Established 1879

St. Paul

Minnesota

**JIM DANDY**  
TIRE REPAIR PLANT

----- TEAR OUT HERE—MAIL TODAY -----

## FREE INFORMATION COUPON

Scheffer & Rossum Company,  
108 E. Tenth, Saint Paul, Minnesota

Gentlemen: Please send full information about how I can start in the tire business with small capital and make a good income. Also your FREE book entitled, "Your Opportunity."

Name .....

Address .....



# How to Make a Stepless Transformer

Home electricians need not blow fuses

By H. H. Parker

AT first thought, a transformer which steps the voltage neither up nor down would appear to be a useless contrivance; but the little

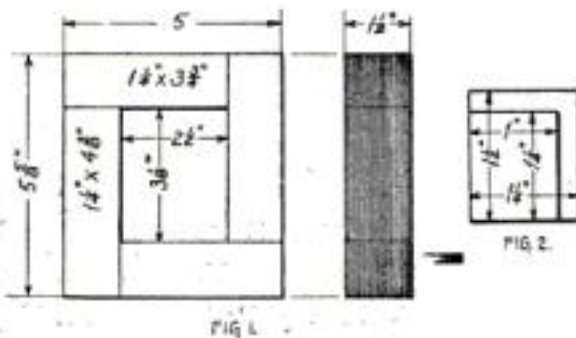


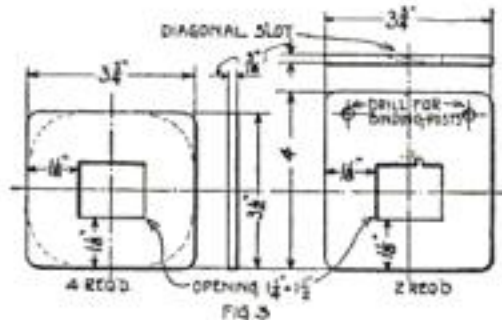
Fig. 1 gives dimensions of the sheets; enough to make one pile. If iron is used the core can be made smaller, as in Fig. 2

apparatus shown in the drawings is designed to act as a safety valve for the experimenter who likes to manipulate his alternating-current house-lighting circuit and who is continually blowing fuses. The transformer will deliver 110 volts at the secondary, and 3 or 4 amperes for intermittent work.

In experimenting, the secondary terminals may be shortened as often as one pleases without affecting the house-circuit; moreover, the coils may be connected in series and the device used as an auto-transformer, delivering 220 volts at the series terminals. If the primary voltage is to be 220, each coil should be wound with twice the number of turns, or 1120, using smaller wire, such as No. 20 d.c.

The core is built up of 1 1/4-in. sheets of "stove" iron, which should be as thin as may be obtained. The dimensions of the sheets are given in Fig. 1.

Enough sheets are used to make a pile 1 1/2 in. thick, though if transformer iron were used the core could be smaller in cross-section (Fig. 2). Make some flanges out of 3/16-in. red fiber, as shown in Fig. 3; pile up the sheets forming the core legs, with alternate ends overlapping 1 1/4 in.; clamp them tightly together, and force the flanges over them. If there is any looseness, force more into the pile, but have exactly the same number in each leg. Then wrap the winding spaces, 1 3/16 in. in length, with insulating tape and start the winding, after an inch or two of the wire has been pushed through the slot in the center flange.



The flanges are made from 3/16-in. red fiber as shown in Fig. 3. Make sure that there are an equal number of flanges in each leg

Use No. 16 d.c. copper wire; there will be 280 turns in each section, twenty turns per layer, and fourteen layers. Attach the outside end to one of the corner binding-posts and begin winding the second section by soldering the wire to the projecting inside end of the first section. Insulate the joint well and wind on 280 turns in the opposite direction, making 560 in all.

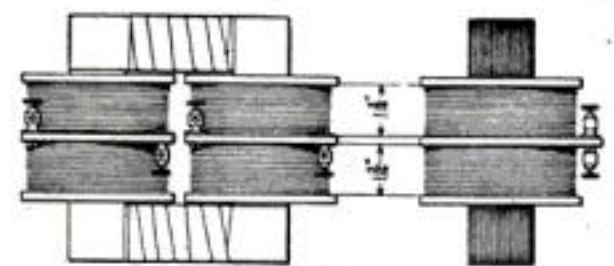
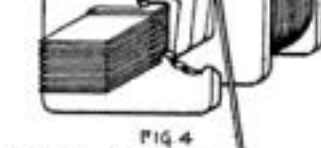
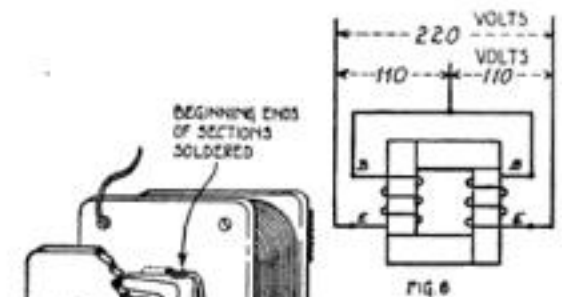


FIG 5

Here is the complete transformer. Make sure that all connections are correct before it is hooked up to the source of current

Wind the second leg in exactly the same way; soak the coils in shellac or insulating varnish and bake in an oven. Fig. 4 illustrates this winding process: the method allows both coil ends to come on the outside of the winding, and furthermore, the center flange serves to hold the laminations tightly together. Next push the yoke sheets into place, tapping with a light hammer if necessary and bind with friction-tape. Fig. 5 shows the complete transformer and Fig. 6 the auto-transformer hook-up.

The apparatus is intended to operate at the usual frequency of 60 cycles; a lower frequency would require a larger core or a greater number of turns in the winding.



This illustrates the winding up process

This illustration shows how the auto-transformer is hooked up

## A Paint-Spraying Device that Saves Effort

PAINTING automobile radiators with a brush is a long and tedious job. If the paint be applied too thick, the function of the radiator is badly impaired; if it be applied too thin, the finish will not last.

Where much painting of this kind is needed a very satisfactory job can be done with a simple and practical spraying device that can be made by anyone. It consists of

elements, of which two sizes and designs are shown in the illustrations. A can to contain the paint has a hollow cylindrical handle A extending at right angles to the side; through it passes a smaller tube B that extends to the other side of the can and above the main body section. A second part, or section C, is placed vertically. Its lower end is close to the bottom of the can,

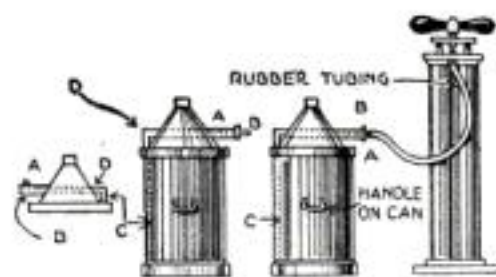
and its upper end is at the extremity of the horizontal tubes B and C, as indicated by the dotted lines.

This is a simple adaptation of the siphon principle with which everyone is familiar, and of which the best exemplification is the atomizer, used in the home. Air is forced through tube B in the

this device must be fairly thin to secure the best results. When painting the radiator, tilt it slightly forward so that the paint may drain from the cooling cells.

Another paint-spraying arrangement can be made by combining a kerosene-can and a tire-pump. The can should be of 1/2-gal. capacity. The handle may be arranged either horizontal or vertical as desired, but the siphon should be made from two brass pipes fixed at right angles, one

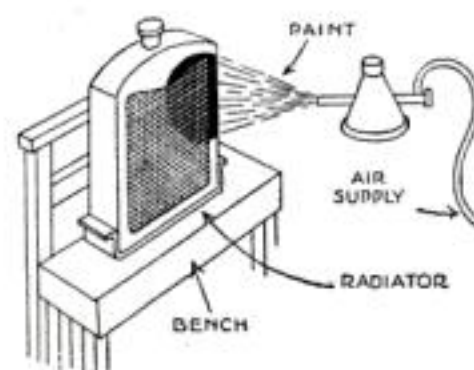
to extend horizontally through the top of the can to afford stability, the other to pass vertically from the top of the can nearly to the bottom. At the tube on the outside of the can there is provided a coupling which receives the tube of the tire-pump, which is operated as usual.—R. L. PRINDLE.



Here are shown the various components of the paint-spraying apparatus

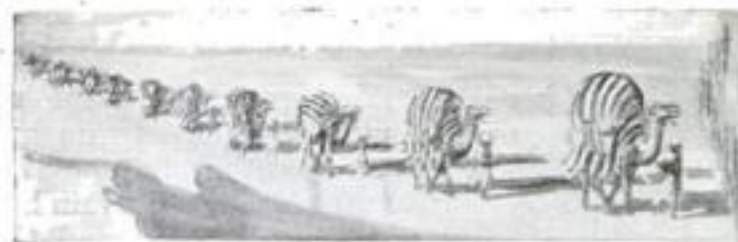
handle, directly across the upper end of the vertical tube C. The liquid inside the can is drawn upward through the tube and sprayed over a wide area.

The mixture of paint used with



The paint from the nozzle goes in a thin cloud to all parts of the radiator





# The Imprisoned Rainbow

To most of us a lump of soft coal is merely a source of heat

**B**UT the chemist sees in it illuminating gas, coke, coal tar, and its by-products, awaiting only the application of heat refining processes to release a beautiful rainbow of colors from its dungeon of darkness.

Four thousand years ago, long lines of camels crossed the desert bearing splendid cloths of purple, red and indigo, dyed in primitive fashion with colors obtained from roots and herbs.

But today, Milady, whether she lives in Mena, Arkansas, or New York, can be just as gorgeously arrayed as were her sisters in Bagdad, thanks to the chemist's magic and to temperature indicating, recording, and controlling instruments perfected by science. For in the distillation and refining processes used in obtaining beautiful aniline colors from coal tar, heat must not only be accurately known but *controlled*.

In scores of the largest and most modern chemical laboratories and dye works *Tycos* Temperature Indicating, Recording and Controlling Instruments are used because of their *dependable accuracy*. Just as they are used in hundreds of other industries.

There are over 8,000 different types and styles of *Tycos* instruments, from the delicate fever thermometer for taking body tempera-

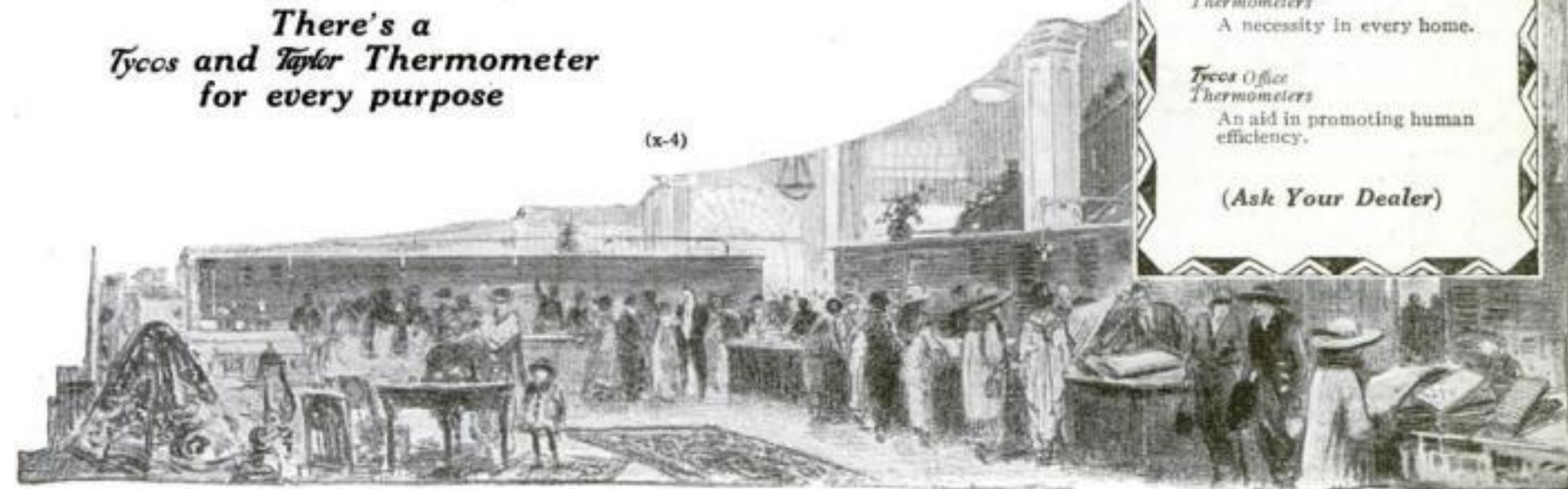
ture to the Fery Pyrometer accurately recording thousandths of degrees of heat.

At the right we list *Tycos* Instruments for the home. Ask your dealer about them. If he won't supply you, write to us direct sending dealer's name. Literature concerning any instrument in which you may be interested will be mailed promptly upon request. Let the recipient decide as to its value and instructiveness.

*Taylor Instrument Companies*  
Rochester, N. Y.

There's a  
*Tycos* and *Taylor* Thermometer  
for every purpose

(x-4)



## *Tycos* Wall Thermometers

To help to maintain a temperature in your house conducive to good health.

## *Tycos* Bath Thermometers

To enable you to get the most good from your bath.

## *Taylor* Home Set

Bake Oven Thermometer. Candy Thermometer. Sugar Meter. The secret of accurate results in cooking.

## *Tycos* Hygrometer

To enable you to keep the humidity of the atmosphere in your home correct at all times.

## *Tycos* Weather Barometers

Forecast the weather twenty-four hours ahead with dependable accuracy.

## *Taylor* Quality Compasses

To show you the right way in unfamiliar country.

## *Tycos* Fever Thermometers

A necessity in every home.

## *Tycos* Office Thermometers

An aid in promoting human efficiency.

(Ask Your Dealer)





## Safety stamps— do you know what they are?

One rarely hears of an electrical fire nowadays.

Thank the safety stamps for this condition, remarkable when thousands of horsepower in electric current is carried over wires, through motors, lights and countless devices of all sorts.

But then, for a long time now electrical materials have passed before a wise censorship—the National Board of Fire Underwriters.

Originally a joint committee of insurance companies, they have outreached their first reason for being and have become a sort of inspirational bureau of standards for all manufactured electrical goods and for electrical construction practice.

They must approve every specialty device and circuit in your home or business property.

They personally inspect all installations so that your electrical work shall be safe from fire risk, and that insurance rates may be minimized.

The Underwriters' safety stamp or written approval is a basis for confidence in things electrical.

Twenty years ago electricity was a mysterious, untrusted, fearsome thing.

But who fears it today?

Not mother manipulating the morning toaster. Not the lineman on the pole. Not even the children around the Christmas tree with their electrical train.

The Underwriters have preached electrical safety—worked to make it practical and, as you will admit, have succeeded.

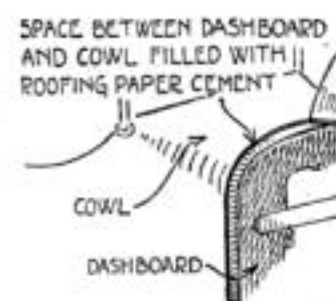
Published in the  
interest of Elec-  
trical Development  
by an Institution  
that will be helped  
by whatever helps  
the Industry.

# Western Electric Company

**No. 6** Visualize a catalog seven inches by ten, with each of its 1100 pages devoted to listings and information on electrical devices and materials. This will give you some idea of the many-sided activity of this Company in serving the public's electrical needs.

## Ford Owners May Safely Go Out in the Rain

**P**ROBABLY there is not one Ford owner out of a hundred who has not, at some time or other, been unable to start his engine because the rain has driven in between the dash and the cowl of the car and short-circuited the



No more dread of rainstorms and shorted coils if you adapt this waterproof device for your Ford

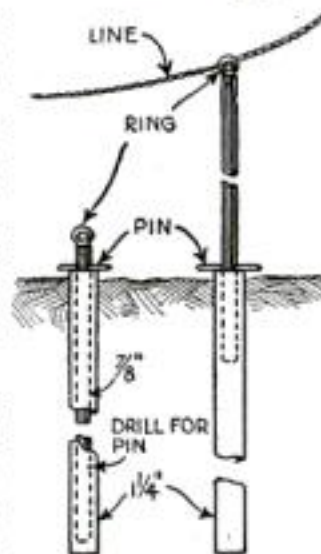
wiring back of the coil-box. This is a common occurrence and the owner has finally to resort to a waterproof cover to protect the opening during wet weather.

One way to cure this nuisance is to fill the space between the cowl and the dashboard, as indicated in the sketch, with the thick black cement which comes as part of the equipment of every roll of roofing-paper.

If the cement is thick from cold weather, warm it until it will flow, and then pour it in a small stream the full length of the seam. The cement will set in a very short time and is a sure cure for the leak.

## A Disappearing Clothesline- Pole for Your Yard

**T**O save space and improve the appearance of the back yard, it is well to have disappearing clothesline-poles like the one shown in the diagram. A length of gas-pipe is sunk to a depth of 6 or 7 ft. and a smaller one is made to telescope into it, forming the pole proper. The outside pipe is 1 1/4 in. in diameter; the other, 7/8 in. The larger pipe should project 2 or 3 in. above the ground to prevent material from working down into it and clogging the end.



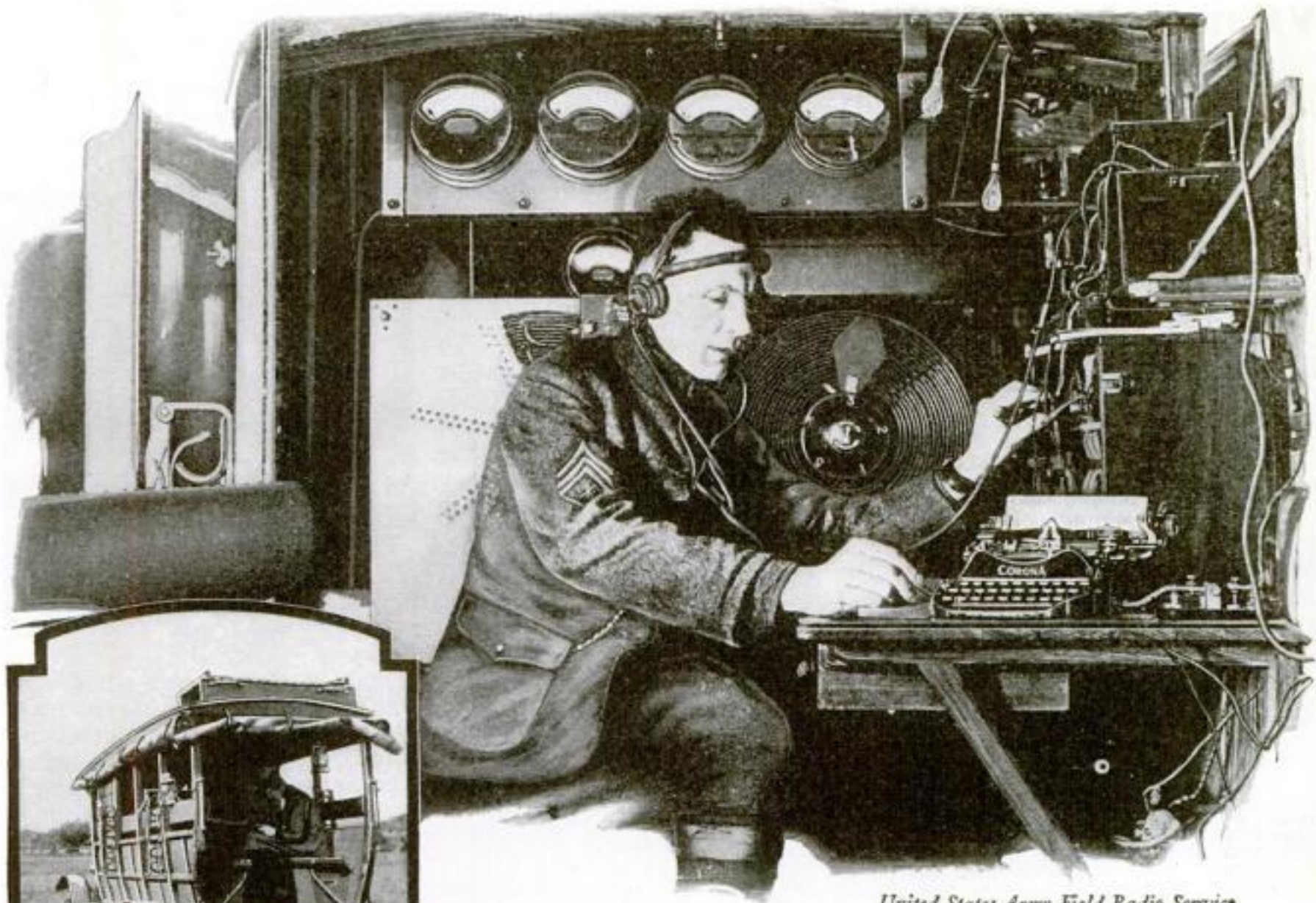
Two holes are bored in the smaller pipe, which takes a small round iron pin to keep it from falling out of sight, and to hold it up to its position when in use.

When your clothespoles are not in use, this device enables you to drop them into the ground out of the way

use. To prevent accidental dropping of the pipe, however, the smaller pipe may be 2 or 3 in. longer than the casing, so that, even when it is dropped it will still extend out of the casing.

The top of the pipe-pole is provided with a looped iron rod to take the line when it is passed through it, as shown in the diagram.—DALE VAN HORN.





United States Army Field Radio Service



Weighs a trifle more than 6 pounds, travels in its own snug carrying case, does standard typing—your choice of elite or pica size type. Folds up like a book. Price \$50 with case. Booklet on request.



## Where Compactness is Vital

WHERE every inch of space must be utilized and every superfluous ounce of weight abandoned, you find little, folding, sturdy Corona doing a man-size job.

Thus its extraordinary compactness and lightness place Corona among the little giants of achievement. As in the modern thin-model watch which keeps perfect time and the pocket camera which makes sharp, clear pictures, so in Corona, inventive genius reduces size while it increases efficiency.

Costly office space, limited traveling quarters, high transportation charges, expensive and none too abundant clerical help—these and a score of other reasons have placed Corona in the hands of over 200,000 users who value it for its unfailing usefulness, its retiring disposition when not busy and its enduring toughness under heavy duty.

Corona Branches and Agencies all over the world

Built by  
CORONA TYPEWRITER CO., INC.  
GROTON, N. Y.

# CORONA

The Personal Writing Machine

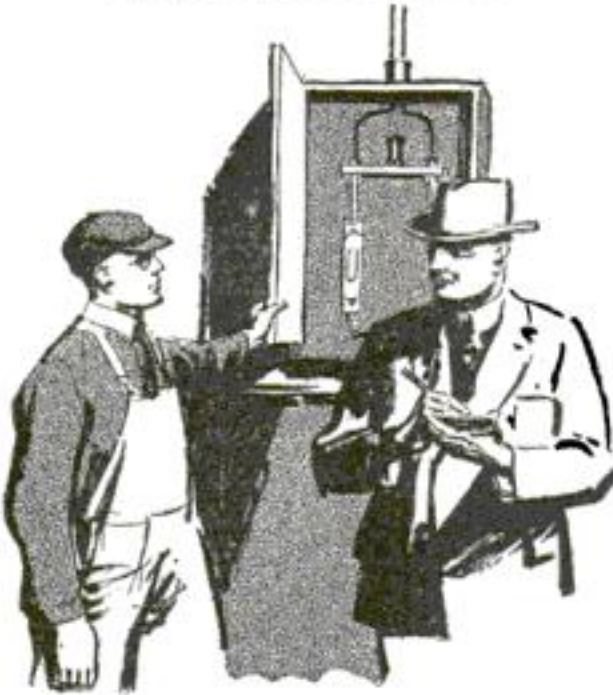
*Fold it up — Take it with you — Typewrite anywhere*



# Electricians' Wiring Manual

By F. F. SENGSTOCK, E. E.

Formerly ELECTRICAL INSPECTOR,  
Chicago Board of Underwriters



## Its Value to You

TO WIREMEN and THE APPRENTICE. It places in your hands compact, practical information applying to any sort of light or power installation in strict accordance with the National Electrical Code. Eliminates trouble by showing how to avoid it. The apprentice, by following its directions, may become an intelligent wireman, able to give, off-hand, reliable installation data.

ELECTRICAL CONTRACTORS will find it a book to place in the hands of their workmen, and one that they will appreciate, because it explains what they want to know without technicalities, and further it gives them the idea of how to do the work from an inspector's point of view, one thing the contractor wants. Supplies valuable estimating data and standard forms and specifications used by companies having long experience.

BUILDING ENGINEERS and MAINTENANCE MEN often called upon to do odd jobs of wiring—you will appreciate the value of this book. It will fortify you against any mistakes and enable you to tackle anything in this line of work.

Twenty-seven Chapters, 448 Pages, 415 Illustrations  
Flexible Binding, Pocket Size, Price postpaid, \$2.50

## Other Practical Books

CONSTRUCTION OF SMALL ALTERNATING CURRENT MOTORS. By A. E. WATSON. This book contains complete instructions for building small alternating current motors in several sizes. The designs will be found in harmony with those of the very best manufacturers and they can be worked out by the amateur for making useful instruments. Fully illustrated. Price postpaid, \$1.25.

### METAL-WORKING

COMPLETE PRACTICAL MACHINIST. By JOSHUA ROSE. One of the best-known books on machine shop work, and written for the practical workman in the language of the workshop. It gives full practical instructions on the use of all kinds of metal-working tools, both hand and machine, and tells how the work should be properly done. It covers lathe work, vise work, drills and drilling, taps and dies, hardening and tempering, the making and use of tools, tool grinding, marking out work, machine tools, etc. No machinist's library is complete without this volume.

5¼ by 8 inches. Cloth Binding. 504 Pages. 395 Illustrations.  
Price postpaid, \$3.25

ARMATURE WINDING. By DAVID P. MORRISON. This book covers the theory of armature winding and the practical application of these principles to the winding of various types of armatures. The book is profusely illustrated with wiring diagrams and photographs of coil winding apparatus and is a thoroughly modern treatment of the subject. Partial tables of contents: DIRECT-CURRENT ARMATURES. Development of the Electromotive Force Equation, General Classification of Armatures, Ring Windings, Lap Windings, Wave Windings, Armature Construction, Commutator Construction, Forming Armature Coils, Winding Armatures, Impregnating and Insulating Windings, Binding Wires, etc. ALTERNATING-CURRENT ARMATURES. Development of Electromotive Force Equation, Single- Two- and Three-phase Winding, Delta and Star Connections, Open and Closed-Circuit Windings, Single and Multiple Circuit Windings, Lap Windings, Wave Windings, Chain Windings, etc. Methods of Reconnecting a Winding for Different Voltage, Frequencies or Number of Poles. Price postpaid, \$2.10.

Book Dept. Popular Science Monthly  
225 West 39th Street, New York

# Measuring Angles with a Watch

By Windsor Crowell

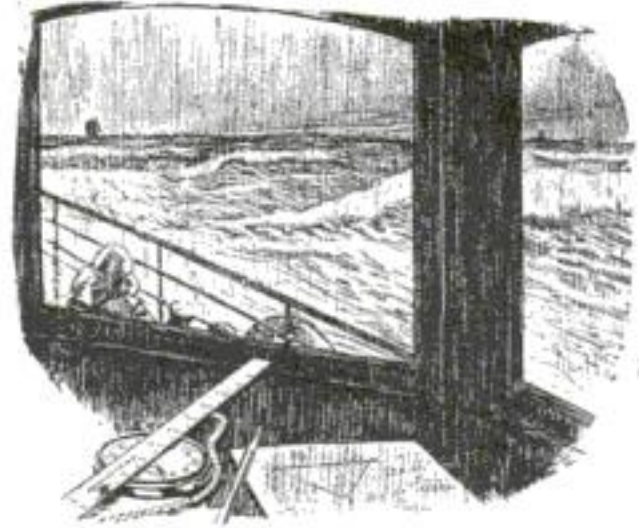
FEW persons realize that rough surveying can be done with a common watch, but such is the case.

By means of this always available instrument, approximate direction and angles can be determined in a few moments, and the uncertainty of location and travel somewhat overcome. This is valuable in desert, ocean and prairie travel.

A watch-face is divided into 12 major sections, indicated by the hours from 1 to 12. As the complete circle consists of 360°, each major section from one numeral to the next would be 1/12 of that, or 30°. Then again, each space between numerals is further divided into 5 equal parts, or minutes, each one of the minutes representing 6°. With this in mind it will be easy to approximate angles.

Suppose, for instance, you are at sea in strange waters and have lost your bearings. You want to find the

case it comes directly over the numeral 4. Then, as there are exactly 3 major sections included in the space between



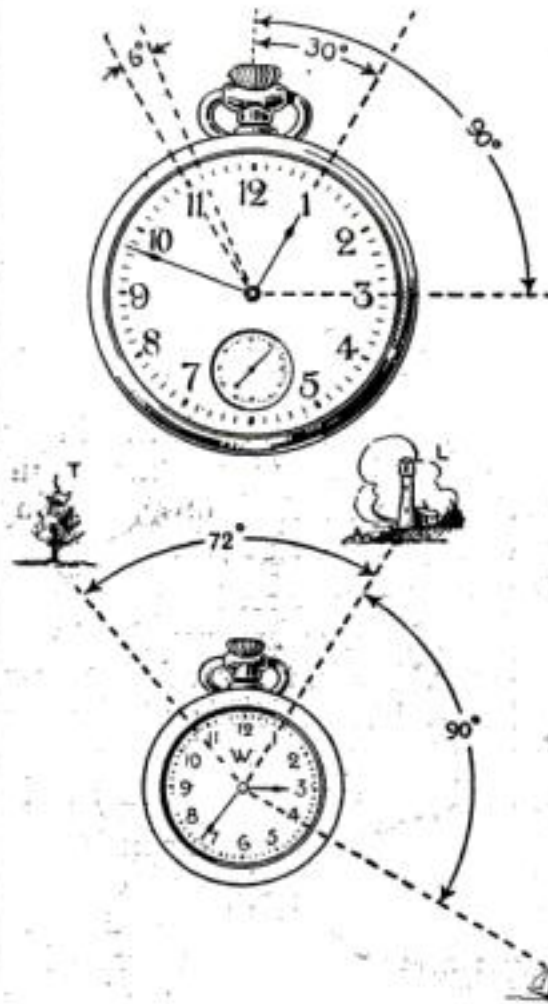
Suppose you were a pilot and the lightning injured your compass. Could you get your bearings with a watch?

1 and 4, and each space represents 30°, the angle *LWB* would measure 90°.

Suppose you want the angle between the lighthouse and another point on the land, represented by the tree *T*.

Take the two directions in the same way, pointing numeral 1 towards one landmark, such as the lighthouse *L*. This time the straight-edge cuts the dial when pointing towards *T*, so that it comes between two numerals and lies over a minute-mark between numerals 10 and 11. Simply add the space between numerals to the space between the remaining minutes. Thus, the space between 1 and 11 represents 60°, and that between 11 and the second minute-mark represents 12°. Their sum is 72°, and means that the angle *LWT* is 72°.

To any one with a meager knowledge of geometry or trigonometry, the finding of resulting distances and directions is a simple matter and some day may stand him in good stead.



Only a slight knowledge of geometry is necessary to use these novel methods of measuring angles

angle between the light house *L* and the distant ship *B*. Then by determining other angles, you will try to ascertain your distance from land. The matter in hand, however, is to find the angle *LWB*.

Take out your watch and lay it down level, the numeral 1 pointing to the lighthouse *L*. A straight-edge, laid across the center of the watch and the numeral 1, and in line with the distant object, will give fairly accurate pointing. Then, leaving the watch in the same position, find where the straight-edge cuts the dial when pointed towards the becalmed ship *B*. In this

## Weighing Poultry or Produce on Homemade Scales

A CONVENIENT set of scales that will take the place of both the spring- and the beam-scales is herein described and illustrated. It can be built by any amateur mechanic in a few hours and at practically no expense. The principle is that of lifting a suspended weight by leverage; therefore there are no springs to weaken or weights to lose.

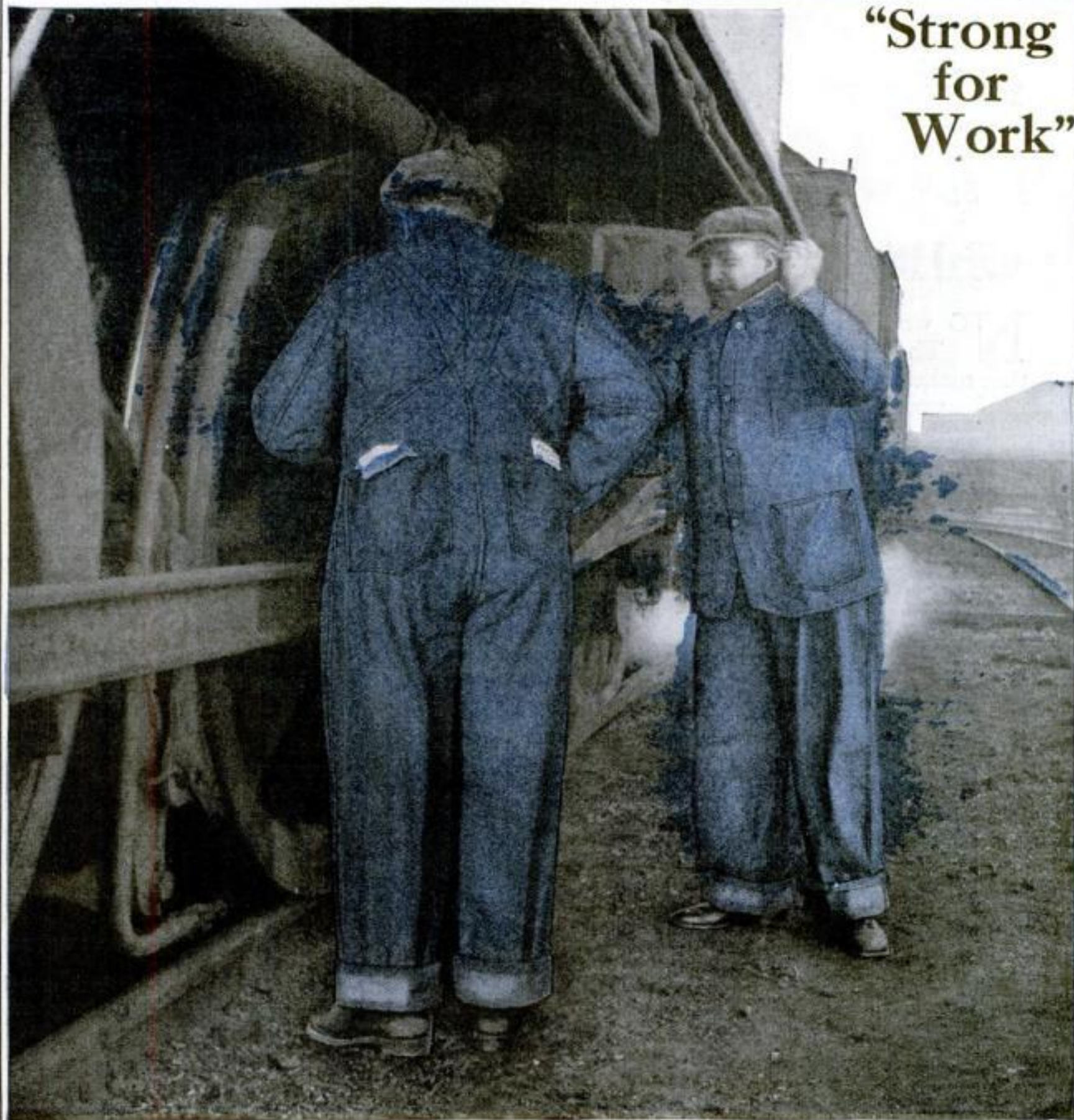
Erect a piece of wood, 2 in. by 4 in. vertically upon a 1-in. plank about 2 ft. long by 1 in. wide. The standard erected should be about 2 ft. high and have a smooth finish.

Then cut out a lever from oak or other heavy, close-grained wood, making it of about the shape illustrated. The top edge must be about 6 in. wide, and the bottom edge, about 15 in. or 18 in. wide. This forms a wedge-



# Blue Buckle Overalls Union Made

**"Strong  
for  
Work"**



"Tuning up" one of the world's largest passenger locomotives for a run on the Atlantic City R. R.



More quality, more comfort and more durability are put into every dollar's worth of Blue Buckle Overalls and Coats than you ever before found in a work suit.

Each garment squares up to the Blue Buckle standard—the *finest work-rig in America!* Test the strength of Blue Buckles' staunch indigo-blue denim;

the riveted brass buttons; brass clasps; the non-splitting reinforced back band; suspenders scientifically cut to stay up on the shoulders! Together with the flawless Union workmanship, these features insure the utmost in wear and comfort your money can buy.

Know the satisfaction of doing a job in the best togs obtainable. *Blue Buckles will delight you!*

**JOBBER OVERALL COMPANY, Inc., Lynchburg, Va.**  
*Largest manufacturers of overalls in the world*





## Oh! it's the magic Figure 8

**N**O wonder they are all crowding around! They all know that it's the magic figure 8 that makes the 1900 Cataract Electric Washer the perfect washing machine.

The figure 8 means that the hot sudsy water is forced through the clothes in a figure 8 motion and *four times* as often as in the ordinary washer.

Then there's the planished copper tub—not a part in it to rub and wear the clothes, pull off buttons, or tear out button-holes! And when you've finished the wash, there are no heavy cylinders to lift out and clean.

The wringer also works electrically and is movable. You can swing it from washer to rinse water, to blue water, to clothes basket without moving or shifting the washer.

The 1900 works quickly too and costs less than 2c an hour to operate. And it washes a whole tubful of clothes spotless and clean in 8 to 10 minutes.

*The water swirls through the tub in a figure 8 movement four times as often as in the ordinary washer*



*Comes in 8 and 12 sheet sizes.*

### Our Special Trial Offer

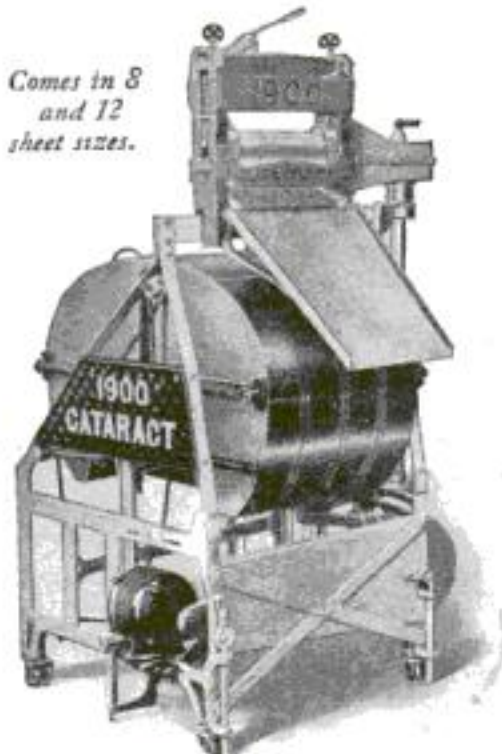
You may prove to yourself that the 1900 is the perfect washing machine. There is a 1900 dealer near you who will gladly demonstrate a 1900 Cataract Washer right in your own home. Then if you wish you may start paying for it on terms to suit your convenience. Remember, we also have washing machines operated by hand and water power.

Write to us today for the name of the nearest 1900 dealer, and a copy of the book, "George Brinton's Wife." It's a story you will enjoy. Molly, his pretty little wife, had troubles of her own until she interrupted a bridge party, and then things began to happen.

## 1900 Cataract Washer

**1900 WASHER CO.**  
206 Clinton St., Binghamton, N. Y.

Canadian Factory and Office:  
**CANADIAN 1900 WASHER CO.**  
357 Yonge St., Toronto



*Just connect it with the electric light and off it starts.*

**1900 WASHER CO.**  
206 Clinton St., Binghamton, N. Y.

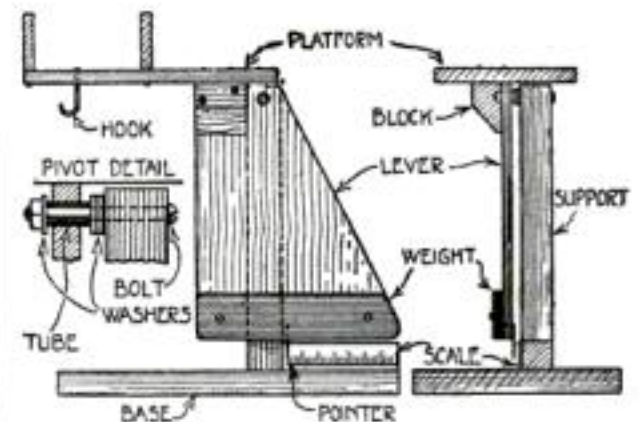
Please send me the name of the nearest 1900 dealer, and a copy of the story, "George Brinton's Wife."



NAME \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
CITY AND STATE \_\_\_\_\_

shaped piece; one edge of it should be perpendicular to the bottom. This is the front. Pivot this lever to the supports with a bolt, as shown in detail, so that it will swing freely and well clear of the standard.

A platform of 1 in. board, 2 ft. long and 1 ft. wide, is then fastened to the top edge of the lever with screws. Two blocks underneath, fastened to



This set of home-made scales takes the place of both the beam- and the spring-scale. It can be made for almost nothing

the lever, help steady it. Two upright partitions should be set on the platform to keep the goods which are being weighed from rolling off. A hook underneath will serve to hang things on.

Next apply sufficient weight to the bottom of the lever so that the front edge will be brought as nearly as possible parallel to the edge of the support.

Make a scale of cardboard, and set it edgewise upon the base in the position shown. Also, set a pointer of stiff wire on the back surface of the lever which will come down in front of the scale without touching it.

To calibrate the scale, set known weights upon the platform, and mark along the scale just where the pointer comes, ounce for ounce, or pound for pound, as the weights are increased. Thus you will always have a fixed scale, and springs or lost weights will not vary it.

Give the whole scale a coating of shellac or varnish to keep out the dampness. Fasten the base to a table or bench, so that heavy loads will not tip it over.—L. B. ROBBINS.

## Taking the Dents Out of a Gasoline-Tank

**V**ERY often an automobile comes into the garage with its gasoline-tank dented, the result of a rear-end collision, or perhaps of backing into a pole or post when the car was about to be parked. While dents do not prevent the proper functioning of the gasoline system, they are nevertheless unsightly and detract from the neatness of its appearance. They can be removed by the following method:

Make a pull rod *A* and end pad *B* as shown in the illustration, and scarf the edge *C*. Solder the lower end of this tool right on to the metal of the tank in the center of the dent as shown at *D*. Cap the tank, apply a





# New Lessons in Shaving

Hot towels and finger rubbing not needed. The secret of softening the beard lies in emulsifying the oil coat on the beard.

## What Science Has Done to simplify shaving

Several years ago we began to make shaving a study in the Palmolive Laboratories.

We were certain there was a scientific way to make each hair cut easily, and we sought to find it.

We studied the beard. We learned that the obstacle in fitting the beard for the razor was the oil that coats every hair of the beard. This oil, we found, did not yield as it should to the ordinary lather. Hence it was difficult for water to penetrate and soften the beard. As a result, men had to apply hot towels or rub with the fingers.

### The solution

The solution to the problem, we knew, lay in a different lather than men were using. And we spent months experimenting with preparations. We tried 130 formulas before we achieved our Palmolive formula and mastered the last remaining problem.

*And that men may know what a difference it makes in shaving we are offering a trial tube free.*

### See how easy

With Palmolive you need no hot towels or rubbing to soften the beard. You just put a bit of the cream on the face, whisk it up into a lather, and your beard is ready for the razor! This is because Palmolive instantly emulsifies the

oil coat on the beard; so the water penetrates quickly.

And such a shave as you enjoy with Palmolive! You never dreamed a razor could glide so smoothly over the face. This is because this lather also lubricates the skin, so the razor can't scrape or irritate.

### Both lather and lotion

Palmolive contains both Palm and Olive oils. Thus it is a lotion as well as a lather. It gives the skin a satin smoothness, a delightful cool "after feel" when shaved. No other applications are necessary.

### Try it free

Note the coupon here. It brings you a trial tube of Palmolive Cream free and postpaid.

Try a Palmolive shave and see what an amazing difference.

Note that you don't have to re-lather with Palmolive, because it stays moist and foamy 10 minutes. A mere bit is ample for a shave. For Palmolive multiplies itself in lather 250 times. There's enough for 152 shaves in our 35c size. A cream so active, as you know, is something decidedly new.

But don't accept our word for the wonders of Palmolive Cream. Be the judge yourself, at our expense. Use a trial tube free. Send for it today.

Large size tube at druggist's, 35c

### Free—A trial tube

Free yourself from old-timeshavingfaults. Know how quick and easy and pleasant shaving can really be. A trial tube of Palmolive will prove a revelation to you. Send for it today. No charge. Simply mail the coupon.



### For a free trial tube

The Palmolive Company,  
Dept. 102, Milwaukee, U. S. A.

Please send me a Free Trial Tube of Palmolive Shaving Cream.

**THE PALMOLIVE COMPANY**  
Milwaukee, U. S. A.





## 40 minutes' use Shows the way to whiter teeth

*All statements approved by high dental authorities*

This test requires four minutes daily for ten days. To millions it has brought a new era in teeth cleaning.

The glistening teeth you see everywhere now should lead you to learn the way.

### That cloudy film

Teeth are clouded by a film. By a viscous, ever-present film. You can feel it with your tongue. Modern research has traced most tooth troubles to it.

Film clings to teeth, enters crevices and stays. If not removed it hardens. The ordinary tooth paste does not dissolve it, so much escapes the tooth brush. Thus well-brushed teeth by millions discolor and decay.

It is the film-coat that discolors, not the teeth. Film is the basis of tartar.

It holds food substance which ferments and forms acid. It holds the acid in contact with the teeth to cause decay.

Millions of germs breed in it. They, with tartar, are the chief cause of pyorrhea.

### The new method

A dental cleaning removes the film-coat, but that is periodic. The need was for a daily film combatant, and science long has sought it. The way has now been found. Able authorities have proved its efficiency. And now leading dentists everywhere are urging its adoption.

An ideal tooth paste has been created to meet all modern requirements. The name is Pepsodent. And this new film combatant is embodied in it.

## A quick convincing test

We now supply to thousands daily, a quick, convincing test. And we urge every home to make it.

Pepsodent is based on pepsin, the digestant of albumin. The film is albuminous matter. The object of Pepsodent is to dissolve it, then to day by day combat it.

But pepsin must be activated, and the usual agent is an acid harmful to the teeth. So this method long seemed barred. Science, however, has discovered a harm-

less activating method, so active pepsin may be daily used on film.

Send the coupon for a 10-Day Tube. Note how clean the teeth feel after using. Mark the absence of the viscous film. See how teeth whiten as the film-coat disappears.

Compare your teeth now with your teeth in ten days. Then decide for yourself the way to beauty and to better protection. This test is most important. Cut out the coupon so you won't forget.

**Pepsodent** PAT. OFF.  
REG. U. S.

*The New-Day Dentifrice*

A scientific film combatant combined with two other modern requisites. Now advised by leading dentists everywhere and supplied by all druggists in large tubes.

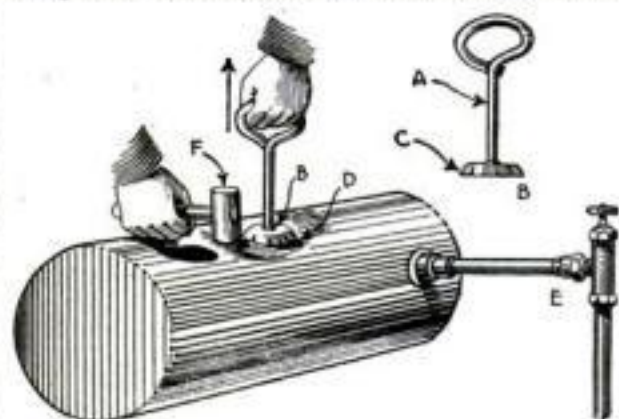
### 10-Day Tube Free

THE PEPSODENT COMPANY,  
Dept. 476, 1104 S. Wabash Ave.,  
Chicago, Ill.

Mail 10-Day Tube of Pepsodent to

*Only one tube to a family*

hydrostatic pressure from the water line *E*, and, while pulling upward on the tool, hammer all around the circumference of the dent, as *F*. It will respond to this treatment and when



Rear-end collisions are unavoidable and usually they dent the gasoline-tanks. Remove them as illustrated

the dent is pulled out, the solder can be melted and removed and the tank given a coat of paint, which will restore it to its original luster.

### A Quick Method of Lining Up Lathe Centers

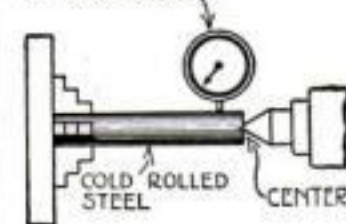
MANY a mechanic, if asked to line up the centers on a lathe, will invariably place the live center and dead center in their respective places, run the tailstock up close to the live center, secure it, and then run the dead center out until it just touches the live center. He takes a squint at their points and if they are apparently the same, he declares the lathe to be in A1 condition.

At its best, this method is only a makeshift depending a great deal on the condition of the center points: the sharper the center points are, the more dependable is the test.

By adopting the following method the alinement of the lathe centers can be determined to within 0.0005 at any point on the bed of the machine.

Place a piece of 1 in. cold-rolled stock in the lathe-chuck so that it projects out about 6 in. After centering with a combination center-drill, peel the center. Now secure a dial indicator in the tool-post so that the point

DIAL INDICATOR FASTENED  
IN TOOL-POST



Lining up lathe centers is easy provided you know how to do it

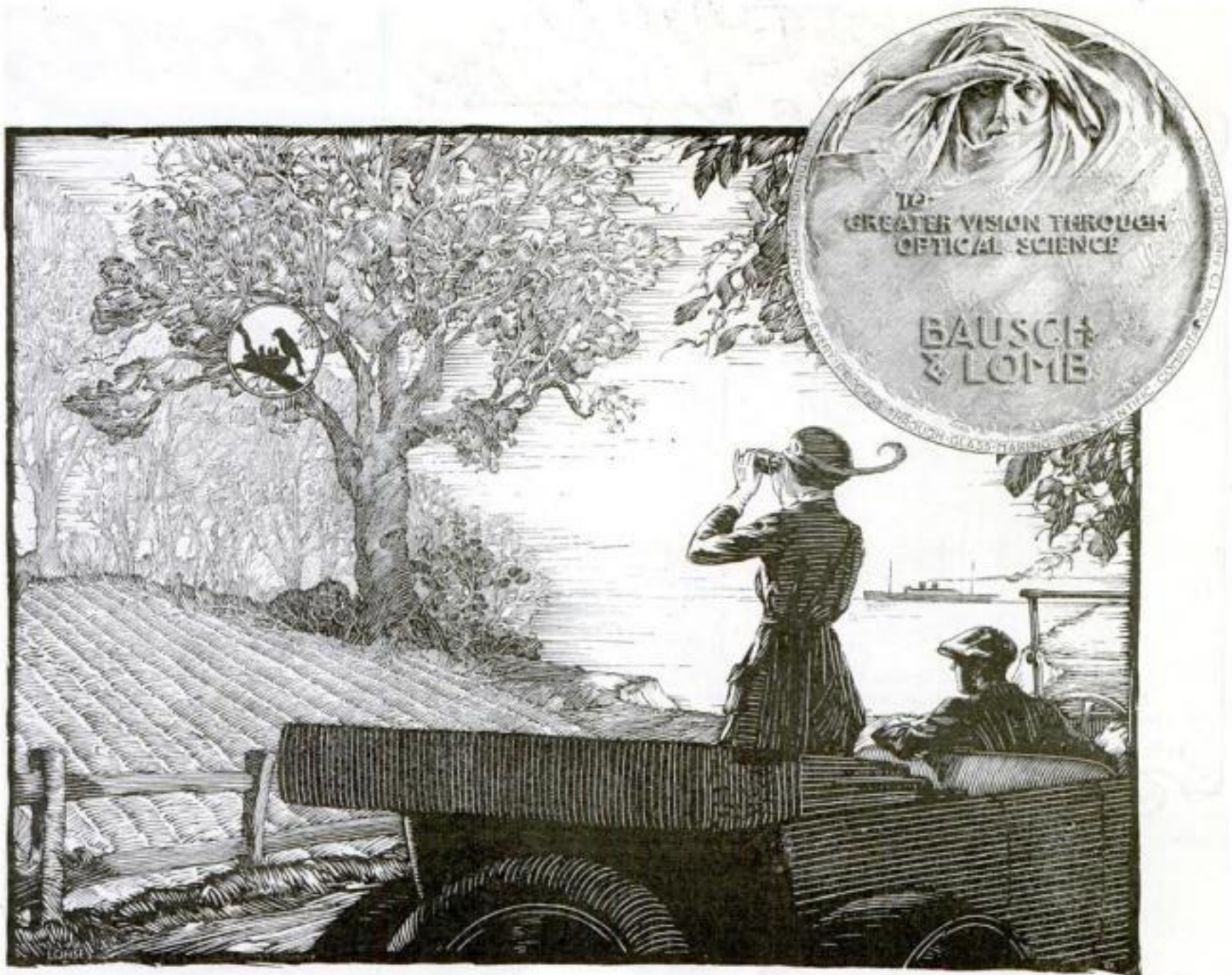
will be directly over the center on top. Set the indicator at zero in tension on top of the stock near the end. Move up the tailstock and clamp it tight. Run out the dead center into the peeled center hole and watch the indicator.

If the lathe is not in line, the tailstock center will pull the piece of stock up or down, and the indicator will record the amount of error.

The tailstock center must be short and stubby, because if it projects out too far, the stock will move the center.

This same test can be applied at four different points—the top, the bottom, and sides.—J. J. MCINTYRE.





## To Help the Eyes See More and Farther —in the Woods, the Air, on Land or Sea

**T**HE eyes of man function at comparatively close ranges. Unaided, they limit his enjoyment of outdoor life to his immediate surroundings and restrict his usefulness in many operations.

But through optics he has gained other and far-seeing eyes to help his own. Binoculars are made to lift his horizon and broaden his landscape, to unveil Nature's inaccessible reaches, to expose hidden dangers of the deep.

On every vessel of our Navy, large or small, with our forces on land and our heroes in the air, the binocular made an unparalleled war record. And we were its chief source of supply, meeting our government's crisis with more than twice as many binoculars in a week as we formerly produced in a year!

Now, in the ways of peace, the binocular is giving a service no less varied and helpful. What autoist does not multiply by many times the interest of his tours, when accompanied by his binocular? Tourist, aeroplanist, sportsman, yachtsman, Nature student—all depend upon it to increase their vision and their pleasure.

Nor is this the only optical product which adds to the comfort, safety and efficiency of life. The microscope, ophthalmic and photographic lenses, projection apparatus, military instruments and others combine to give a service to the world, which we are proud to have been developing along lines of precision and quality since the middle of the last century.

*Write for literature on any optical product in which you are interested*

**BAUSCH & LOMB OPTICAL COMPANY . . . . . ROCHESTER, N. Y.**  
*Makers of Eyeglass and Spectacle Lenses, Photographic Lenses, Microscopes, Balopticons,  
Binoculars and Engineering and other Optical Instruments.*





# Silvertone

**The Better  
Phonograph For  
Less Money**



**Louis Quinze Period Design.**  
Mahogany or Walnut. Gold Plated Metal Parts.  
Model XVI Price, \$195.00  
Dimensions over all, 50 1/2 inches high,  
24 1/2 inches wide and 24 1/2 inches deep.  
Net weight, ready to play, 120  
pounds. All visible metal parts  
are heavily gold plated. Assort-  
ment of needles included.

**\$6.00**  
A Month



**Louis Seize  
Period Design.**  
Mahogany or Walnut. Gold Plated Metal Parts.  
Model XV Price, \$175.00  
Dimensions over all, 49 1/2 inches  
high, 23 inches wide and 23 1/2  
inches deep. Net weight, ready to  
play, 108 pounds. All visible metal  
parts are heavily gold plated. An  
assortment of needles included.

**\$5.50**  
A Month



**Louis Quinze  
Period Design.**  
Mahogany, Walnut or Fumed Oak.  
Gold Plated Metal Parts.  
Model XI Price, \$145.00  
Dimensions over all, 46 1/2  
inches high, 19 1/2 inches wide and  
21 1/4 inches deep. Net weight,  
ready to play, 82 1/4 pounds in  
mahogany or walnut and 87 1/2 pounds  
in oak. All visible metal  
parts are heavily gold  
plated. An assortment of  
needles included.

**\$5.00**  
A Month

## Send No Money

**T**HE SILVERTONE Phonograph was designed and built to meet the demand for a good phonograph at a reasonable price. That it succeeded in fulfilling these requirements is proved by the fact that over two hundred and fifty thousand satisfied owners are unanimous in their praise of the SILVERTONE.

No effort or expense has been spared to make the SILVERTONE the best phonograph we could build. Experts in acoustics and mechanics have been kept constantly at work developing and perfecting new and better phonograph devices and mechanisms for use in the SILVERTONE. Skilled furniture designers have created cabinets worthy of SILVERTONE quality—artistic, harmonious and dignified. None but the finest of woods and other materials enter into SILVERTONE Phonograph con-

struction, and they are fitted and finished with exquisite care and perfection. SILVERTONE quality is supreme.

And we have kept the price of SILVERTONE Phonographs within the reach of all. Building phonographs in enormous quantities, as we have to do to meet the requirements of our six million customers, has enabled us to reduce the manufacturing cost per phonograph to the very minimum. And selling them direct from factory to customer makes it possible for us to offer SILVERTONE Phonographs at prices which are much lower than those of any other instrument of the same high quality.

We believe that when you see the SILVERTONE and hear it play, you will be convinced of the truth of our claims for it. That is why we are making this liberal trial offer. We want you to try a SILVERTONE in your home for two weeks without the payment of one cent, and without obligating you in any way. Here is the offer:

## No Money Down—Two Weeks' Trial

Select any SILVERTONE Phonograph shown on this page, fill in the order blank at the bottom of this page, and mail it to Sears, Roebuck and Co., Chicago, Ill. **Send no money with it!** We ship SILVERTONE Phonographs on two weeks' trial. This trial will not cost you one cent, nor obligate you in any way. All we ask you to do is to give the phonograph a thorough trial. Examine its mechanical features, cabinet work and finish. Try it with any records you desire and note its beauty of tone, how faithfully and accurately it restores every delicate shading of tone quality, every minute variation of volume, every sound vibration. Give it every test necessary to prove the truth of our claims for it. And then compare the price of the SILVER-

TONE with that of any other phonograph of the same size, quality and musical excellence. If at the end of this two weeks' trial you are not fully satisfied with the phonograph, if you do not believe that mechanically, musically and in workmanship, material and finish it is the equal of any other phonograph on the market selling at from 25 per cent to 50 per cent higher in price, simply notify us and we will take away the phonograph at our own expense, and will return any transportation or cartage charges you have paid.

### Small Monthly Payments

If, at the end of two weeks' trial, you are fully satisfied with the SILVERTONE and desire to

keep it, send us the price of the phonograph you have selected in equal monthly payments until the total is paid. The amount of the monthly payment is shown under the illustrations of the various models. There is no interest or extras of any kind to pay.

Fill out the order blank today, before this paper gets out of your hands, and let us send you one of these beautiful 1920 SILVERTONE models for two weeks' trial in your home, without having to pay a cent down on the phonograph, and without obligating you in any way. You are to be the sole judge of the quality and value of the SILVERTONE.

# Sears, Roebuck and Co.



**The Reproducer.**

Tone quality is dependent upon the reproducer, tone arm and amplifying chamber. Each must be designed and harmonized in its relation to the other two in order to produce a sweet, pleasing tone. The SILVERTONE reproducer restores every sound vibration. Designed so that all scratching and mechanical noises are reduced to the minimum.

**Plays All Disc Records.**

The SILVERTONE convertible tone arm permits the playing of any make of disc record. A universal joint in the tone arm makes it possible to adjust the reproducer at will so that it will play either vertical or lateral cut records. It is almost as easy to adjust the reproducer for different types of records as it is to change needles.

**Amplifying Chamber.**

The sounds carried from the reproducer through the tone arm are given volume and resonance in a scientifically designed amplifying chamber or horn. This chamber is built of carefully seasoned wood and, like the sounding boards of a fine violin, imparts to the reclaimed sound vibrations sweetness and resonance.

**Tone Control.**

The tone modulator with which each SILVERTONE is equipped gives complete control over the volume of sound. You may set the modulator at any desired point, thus giving a uniform volume of sound, or the modulator may be manipulated while a selection is being played, thus enabling you to impart your own interpretation to the music.

**Powerful, Silent Motor.**

Every part of the SILVERTONE motor is made and fitted with care and precision, and gears mesh silently. Powerful springs furnish an abundance of power, and a perfectly designed governor keeps the turntable speed absolutely uniform. The motor is equipped with a silent winding device and cranks with very little effort.



**Heppelwhite  
Period Design.**  
Mahogany, Fumed  
or Golden Oak.

**Model IX** Price, \$100.00  
Dimensions over all, 46 1/2 inches high, 20 inches wide and 22 inches deep. Net weight, ready to play, 69 pounds in mahogany and 74 pounds in either fumed or golden oak. Metal parts are heavily nickel plated and polished. An assortment of needles included.

**\$4.50**  
A Month



**Adam Period  
Design.**  
Fumed Oak.

**Model VIII** Price, \$80.00  
Dimensions over all, 42 1/2 inches high, 19 1/2 inches wide and 22 in. deep. Net weight, ready to play, 76 1/2 pounds. All visible metal parts are heavily nickel plated and polished. An assortment of needles included.

**\$4.00**  
A Month



**Queen Anne  
Period Design.**  
Mahogany.

**Model VII** Price, \$57.00  
Dimensions over all, 14 1/2 inches high, 19 1/2 inches wide and 23 1/2 inches deep. Net weight, ready to play, 39 1/2 lbs. All visible metal parts are heavily nickel plated. Assortment of needles included.

**\$3.50**  
A Month



**Golden Oak.**

**Model VI** Price, \$48.00  
Dimensions over all, 14 1/2 inches high, 18 1/2 inches wide and 22 1/2 inches deep. Net weight, ready to play, 42 1/2 lbs. All visible metal parts are heavily nickel plated. Assortment of needles included.

**\$3.00**  
A Month

USE THIS ORDER BLANK—CLIP ALONG DOTTED LINES.

**Order Blank**

SHIP BY Freight ☐ Express ☐

Soars, Roebuck and Co., Chicago. Date \_\_\_\_\_ 19\_\_

You may ship me the SILVERTONE Phonograph which I have marked with an [X] for two weeks' trial.

If, after two weeks' trial, I decide to keep and use the instrument, I will send you the first payment for the phonograph, and pay the same amount each month, until paid in full; then the SILVERTONE becomes my property.

Should I decide, after two weeks' trial, that the SILVERTONE is not satisfactory, I will notify you, and you are to give me instructions so that I may send it back at your expense. You are also to return to me any transportation and cartage charges I have paid.

I have always been faithful in paying my obligations and am making this statement for the purpose of inducing you to grant me these terms, and I give you my pledge that you may feel safe in trusting me to pay as agreed.

Sign Here \_\_\_\_\_

(Sign your name here plainly and carefully. If under age, some member of your family who is of age and responsible should sign this order with you.)

R. F. D. \_\_\_\_\_ Box \_\_\_\_\_ Street \_\_\_\_\_  
No. \_\_\_\_\_ No. \_\_\_\_\_ and No. \_\_\_\_\_

Postoffice \_\_\_\_\_ State \_\_\_\_\_

Shipping Point \_\_\_\_\_ State \_\_\_\_\_  
I have been located in \_\_\_\_\_ If less than 5 years,  
this town since \_\_\_\_\_ give former address \_\_\_\_\_

My business, occupation or profession is \_\_\_\_\_

Please give name of head of household to prevent mistakes and simplify the keeping of our records.

Name of head of household \_\_\_\_\_

(Please give names of TWO references.) REFERENCES: 91P85

Name \_\_\_\_\_  
Address \_\_\_\_\_  
Business or Occupation \_\_\_\_\_

**Period Design Cabinets.**

**S**ILVERTONE Cabinets are the finest product of the skilled cabinetmakers' art. Made in the most popular period designs, every one is a handsome piece of furniture—dignified, graceful and artistic in appearance. Only the finest selected woods are used in their construction and they are finished and fitted with that exquisite care and perfection which mark the work of the painstaking artisan.

# Chicago



# Dayton Bicycles



## The Thrill of a Lifetime



We back this Trade-Mark with our reputation.

GO where the water sparkles and ripples in sunshine and shadow—go where a tug on your line sends a thrill from head to toe—go *when* you will and *where* you will—your bicycle is ready, waiting and willing.

Get out your rod and tackle box—and hop to it! Swift, glorious flight, combining both comfort and

health. A bicycle saves time and money, too—and will help you work as well as “play.”

Buy a bicycle *now* and be particular. Buy a Dayton Bicycle, the acknowledged leader—backed by 25 years’ experience, skill and reputation.

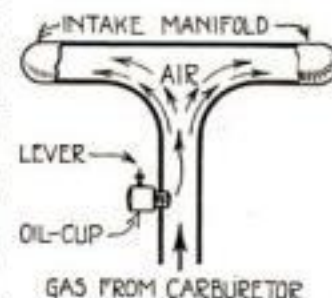
Write today for your dealer’s name and copy of our handsome catalog No. 44, showing 8 splendid new 1920 Dayton Models for men, women, boys and girls. Learn what a Dayton Bicycle will do for you.

Cycle Dept., THE DAVIS SEWING MACHINE CO., Dayton, Ohio

*“Ride a Bicycle”*

## Allow Your Automobile Engine to Breathe

**C**HANGES in temperature affect the carburetor to such an extent that in many cases adjustments must be modified to meet atmospheric conditions. An air-valve attached to the intake manifold will eliminate much of this trouble, for then the air adjustment can be changed by the simple turning of a lever.



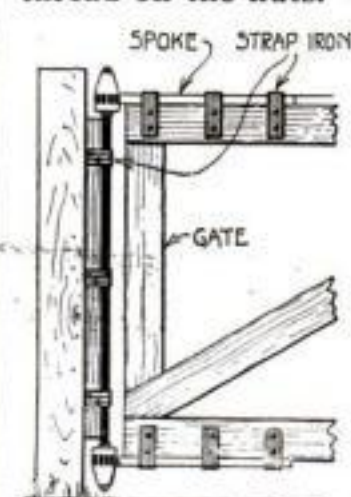
Your engine will run much better if you attach an auxiliary air-valve to the intake manifold

The most simple, yet effective, auxiliary air-valve is that made by threading a Ford oil-cup into a hole in the side of the intake manifold. A metal strip  $\frac{1}{2}$  in. wide is soldered to one side of the movable part of the oil-cup, which will then form a lever to control the opening and closing of the valve. A hole is drilled near the end of this lever and a length of wire attached. This wire runs through copper tubing to the steering wheel, where it is manipulated at the will of the car driver. —R. L. PRINDLE.

## Buggy-Axles and Wheel-Hubs Make Good Gate-Hinges

**T**HE next time you have a spare buggy-axle and a gate that needs new hinges, make them work together in the cause of economy.

Clamp the axle to the gate-post, as shown in the illustration, so that the bottom end of the axle will come 3 or 4 in. from the ground. Put the hubs of the wheels on the axles, and thread on the nuts. Leave one spoke

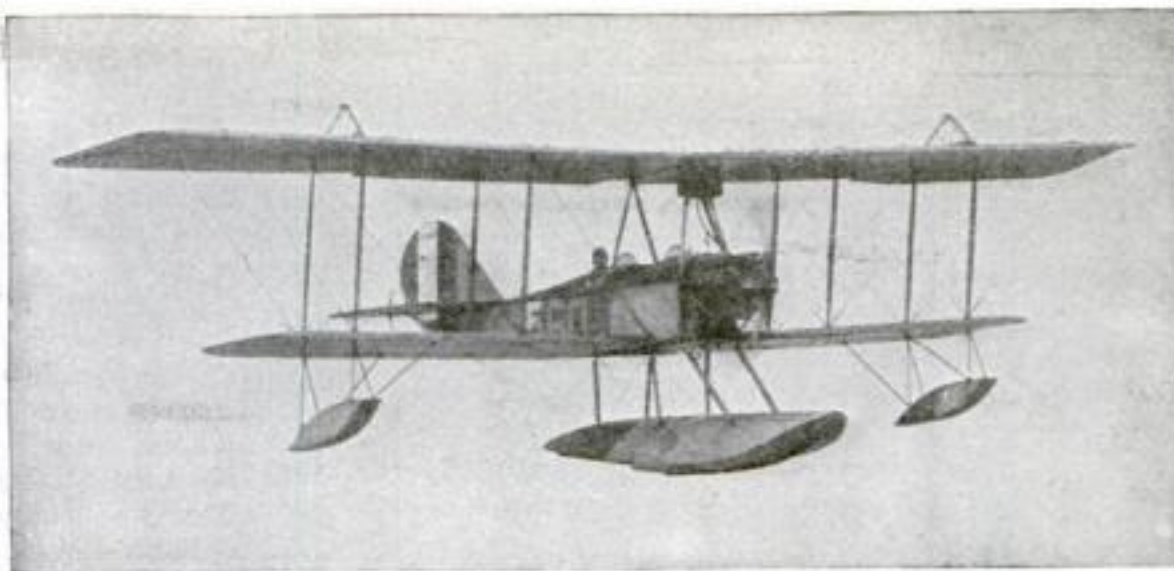


in each hub, and use it to clamp to the bottom and top boards of the gate. Three or four little U-shaped clamps, looped over the spoke and screwed to the gate, will hold it firmly.

The axle will have to be fastened to a piece of wood, and the wood secured to the gate-post, if the post is longer than the axle.

This is a good solid way of suspending a gate, and the axle will outwear several pairs of ordinary hinges, provided it is greased and painted to withstand the elements. The axle-hinge has also the virtue of being easily adjusted. —THORNTON HALLETT.





## NAVY SALE OF SEAPLANES

A large quantity of seaplanes, spare parts and accessories are offered for sale by the NAVY at fixed prices. This is an unusual opportunity and should be given careful consideration by everyone who is interested in aviation.

### PLANES ARE NEW—NEVER HAVE BEEN FLOWN

and most of them are still crated as received from the makers. They have been well taken care of and are in excellent condition. We advise immediate action, as orders will be accepted and filled in the order in which deposits are received. The following are offered:

**HS-2-L TYPE FLYING BOATS**—pusher biplane—one Liberty engine of 300 H. P.—wing spread (Upper plane) 74 ft., total supporting surface 803 sq. ft.—maximum speed 85 miles per hr. Sale price.....\$6,160

**H-16 TYPE FLYING BOATS**—tractor biplane—two Liberty engines of 330 H. P. each—wing spread 95 ft.—total wing surface 1,164 sq. ft.—maximum speed 95 miles per hr. Sale price \$11,053

**F-5-L TYPE FLYING BOATS**—essentially same as H-16 (lot 2) but larger—wing spreads 104 ft.—total area 1,397 sq. ft.—maximum speed of 87 miles per hr. Sale price.....\$12,400

**AEROMARINE TYPE 39-B SEAPLANE** (pictured above)—tractor biplane—Curtiss 100 H. P. engine—wing spread 47 ft.—total area 494 sq. ft.—maximum speed 72 miles per hr. Sale price.....\$3,000

This we consider our best buy. Endorsed by NAVY flyers as the safest and most easily operated seaplane. A manufacturer is marketing a set of wheels and tail skid which, substituted for the pontoon, converts this into a successful land plane.

**MODEL 40 FLYING BOATS**—pusher biplane—one Curtiss 100 H. P. engine—wing spread approx. 48 ft.—total area

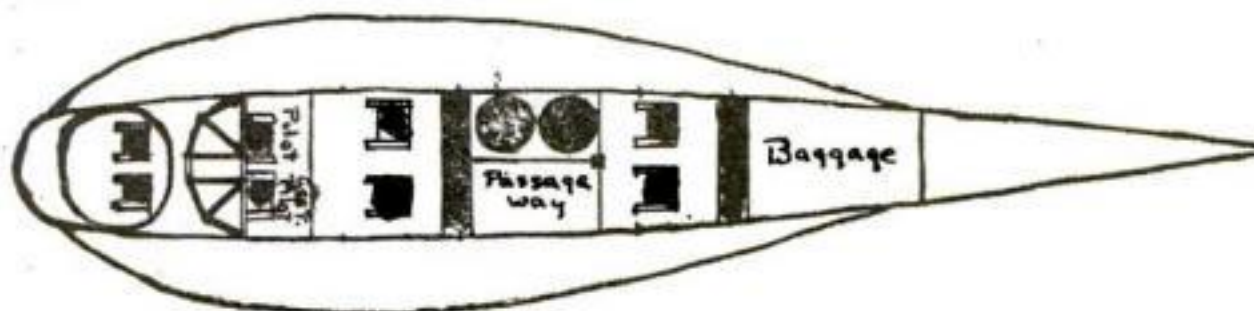
504 sq. ft.—maximum speed of 70 miles per hr. Sale price.....\$4,000

**CURTIS GNOME SPEED SCOUTS**—complete with Gnome engine installed. Never flown. Packed in original cases. Sale price.....\$2,000

**BOEING SEAPLANES**—tractor biplane—one Hall-Scott 100 H. P. engine—wing spread 44 ft.—total wing area 495 sq. ft.—maximum speed of 72 miles per hr. Sale price.....\$2,000

**TYPE "R" KITE BALLOONS**—Used for observation and instruction purposes. Towed by vessels and also flown from land. Sale price.....\$2,500

Those who follow aerial affairs closely, no doubt noticed a recent newspaper item which told of a record-breaking flight from Miami, Fla., to Bemini, Bahama Islands, by a seaplane, carrying sixteen and baggage. The plane making this record was a type H-16 flying boat (lot 2) purchased from the NAVY and was originally designed to carry four persons. The sketch shows how it was converted to carry **SIXTEEN PERSONS AND BAGGAGE** at a cost of about \$1,000 for the necessary alterations. You can do the same.



### 5% OF PURCHASE PRICE—BUYS A PLANE

Just send to the Bureau of Supplies and Accounts, Navy Department, 5% of the amount of your order, with your order, and the goods are yours, subject, of course, to prior sale. This deposit can be by certified check or money order drawn to the order of the Paymaster General of the Navy, or the bond of a surety company acceptable as sureties on Federal Bonds. The balance shall be paid within 30 days after acceptance of your order.

### ENGINES AND SPARE PARTS

In addition to the planes the NAVY is offering a number of sets of spare parts, at fixed prices, which can be purchased with or without a plane. **ENGINES**, new and used, are offered in an astonishing assortment and at prices equally astonishing. The list includes: **RENAULT, HALL-SCOTT, CURTISS V-2, ISOTTA-FRASCHINI, STURTEVANT, CURTISS OX AND OXX, GNOME, FIAT** and the **LIBERTY**. The prices range from 175 to 2000 dollars according to make and condition.

### ORDER FROM THIS ANNOUNCEMENT AND AVOID DISAPPOINTMENT

Several lots included in the sale at the start are completely sold out, several times as many orders being received as there were planes for sale. Orders will be attended to in rotation as they come in, so we advise ordering from the descriptions given above. But for those who desire additional information the NAVY has prepared a beautifully illustrated catalogue which will be sent free on request to the

**BUREAU OF SUPPLIES AND ACCOUNTS  
UNITED STATES NAVY  
WASHINGTON, D. C.**





QUALITY EVER MAINTAINED

TIMES CHANGE BUT LEAVE  
UNCHANGED THE QUALITIES  
WHICH HAVE MADE B.V.D. THE  
WORLD-WIDE STANDARD  
OF SUMMER COMFORT.

NO UNDERWEAR IS B.V.D. WITHOUT  
THIS RED WOVEN LABEL



THE B.V.D. COMPANY  
NEW YORK

## A Steffey Motor Attached to Your Wheel



will Convert it into a High-Grade, Practical and Successful Motor-Cycle, that will cost you less to operate than the heavy machine. Write at once and secure low factory prices. Excellent opportunity for hustling agents. Send stamp.

**STEFFEY MFG. CO.**

Dept. S, 5025 Brown Street, Phila., Pa.



**RAILWAY  
TRAFFIC  
INSPECTORS  
ASSOCIATE  
WITH  
BIG MEN**

That is what gives them chances for promotion. They start in at a good salary—\$110.00 a month and expenses.

The work is important, for the safety of thousands depends on their vigilance. And when they do their work as we teach them they attract the favorable attention of their superiors. Promotions then are rapid.

### Learn This Profitable Profession

All you need is a common school education for entrance to our three-month's course, which is easy to learn at home during your spare time. Take the initiative now, while the demand for Railway Traffic Inspectors is so good. THERE IS A BIG DEMAND IN THIS FIELD.

We know of fine openings for our graduates. Many who started our course a few months ago now hold positions.

OUR BOOKLET tells of this ideal vocation—out in the big out-doors—how you associate with big men—how you can earn an excellent salary from the start—how you can climb to the very top. The opportunity COUPON (below) is your key to a better salary now and a much bigger future. Why not send it today? Remember you start at \$110 a month, and WE SECURE YOUR POSITION.

Standard Business Training Institute,  
BUFFALO, N. Y.

Please send, without obligation to me,  
your Booklet D-97, explaining your Railway  
Traffic Inspector's Course.

Name .....  
Address .....



## Cleartone Phonographs \$4.00 to \$200.00 Retail

Our Sundry Dept. offers Needles 20c per thousand. Motors \$1.35 to \$14.75 each. Tone-Arms and Reproducers \$1.30 to \$3.75 per set. Main Springs 25c to 50c each. Records, Needles, Sapphire Points and Parts at reasonable prices.

Write for our 84-page catalogue, the only one of its kind in America, illustrating 33 different styles of Talking Machines and over 600 different Phonographic Parts.

LUCKY 13 PHONOGRAPH COMPANY

Expert Dept. 466, E. 12th Street, N. Y., U. S. A.

BE AN EXPERT

*Inman*

Wonderful, new device, guides your hand; corrects your writing in few days. Big improvement in three hours. No failures. Complete outline FREE. Write C. J. Ozment, Dept. 52, St. Louis, Mo.

## Learn to Dance!

You can learn Fox-Trot, One-Step, Two-Step, Waltz and latest "up-to-the-minute" society dances in your own home by the wonderful Peak System of Mail Instruction.

New Diagram Method. Easily learned; no music needed; thousands taught successfully.

Write for Special Terms. Send today for FREE information and surprisingly low offer.

WILLIAM CHANDLER PEAK, M. S.

Room 110, 521 Crescent Place—Chicago, Ill.



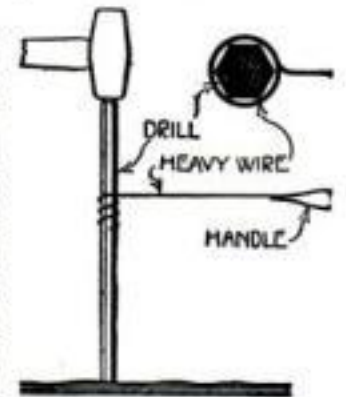
Shipfitters, Structural Workers, Carpenters, Bricklayers, Mechanics, Plumbers, Pipefitters, Boiler-makers and others can earn more money if they know how to read Blue Prints. By our method, we train you in a short time. Write for Catalog B, stating trade. We also teach Drafting. Be a Draftsman! Earn big money. Draftsmen in demand. Books and tools FREE. Write for Catalog G.

COLUMBIA CORRESPONDENCE SCHOOL Est. 1904  
Dept. U, Drexel Bldg., Phila., Pa.

## A Safety Handle-Holder Makes Drilling Safer

A CIVIL engineer reports that the drill operators on a big construction site in a nearby city, have devised this "safety first" drill-holder or handle.

A length of heavy iron wire is looped a few times at one end to hold the drill, and bent at the other to form a hand-grasp. The loops are loose enough to allow the drill to rebound and turn after each blow. The length of the handle enables drill-holder to keep his hand at a safe distance from the hammer.—JAMES M. KANE.

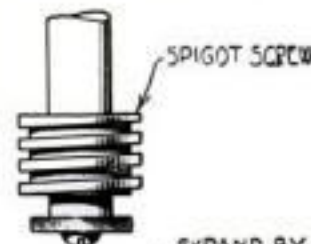


No more mashed fingers for drill operators if they use this wire handle

## To Make an Old Spigot Last a Short While Longer

WHEN the screw of a spigot becomes so worn that it refuses to catch, it looks like a hopeless case. Still, it can be repaired so as to tide over for a few days, or even longer.

Unscrew the cap and remove the stem. Take out the small screw at



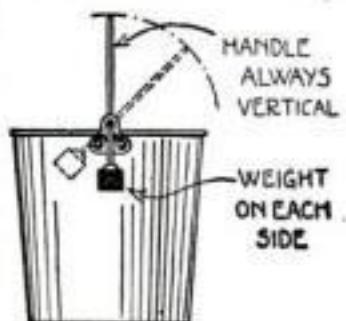
Don't throw that old spigot away. Repair it in this manner

hard, or it will not fit in place.

A spigot fixed in this manner, will not need to be bridled down with a cord, and it will serve the purpose until a plumber comes around.

## Treat Your Fingers to the Pail with a Trick Handle

THIS pail is different from all other pails in that the handle always remains vertical and ready to be grasped by the workman. Although the handle automatically goes back to its vertical position, it may be pushed down out of the way while the pail is being filled or emptied.



The handle of this pail is always in position to be grasped

The handle is simple to make. An





## Bicycles Are Like Autos When It Comes To Tires

**I**MAGINE a high-priced, high-class car with shoddy, weak-bodied tires. It would be out of the running in a hurry, wouldn't it?

The better the car the more careful the owner is about the tires.

The makers of U. S. Bicycle Tires have at stake the same U. S. Tire reputation that car owners and truck owners rely upon. All the resources, men and equipment of the United States Rubber Company, oldest

and largest in the world, stand back of your U. S. Bicycle Tire investment.

Nine different styles, both clincher and single tube. Choose the tread that suits you best.

If you want to know about the rubber that goes into U. S. Bicycle Tires, write for a copy of the graphically illustrated and fascinatingly written book, "Rubber—A Wonder Story." Address U. S. Rubber Company, Bicycle Tire Division, New York.

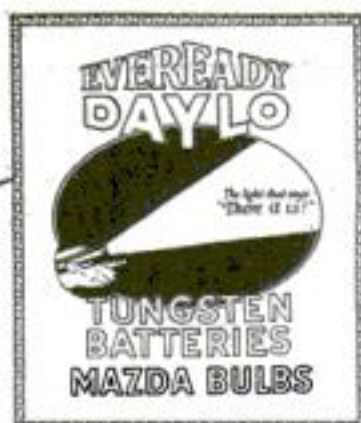
"Ride a Bicycle"



# United States Tires

## United States Rubber Company





*This is the sign that identifies  
dealers showing the Eveready  
Daylo \$10,000 Contest  
Picture. Look for this  
sign on dealers'  
windows*

## Three Thousand Dollars For Somebody. YOU?

**T**HREE thousand dollars in cash for one person; a thousand dollars for another; five hundred for each of three other people and ninety-nine other cash prizes from two hundred to ten dollars. **Ten thousand dollars** in all! How much for YOU?

This latest Eveready Daylo Contest will break all contest records. Anyone may enter—it costs nothing; there is no obligation of any kind. Men, women, boys and girls all have equal chances for any of the 104 cash prizes.

On June 1st, Daylo dealers throughout the United States and Canada will display the new Daylo Contest Picture in their windows. Go to the store of a Daylo dealer and study the picture. Secure a contest blank, which the dealer will give you, and write on it what you think the letter says. Use 12 words or less. For the best answer that conforms to the contest rules, the winner will receive \$3,000.00 in cash.

Get an early look at the picture. Submit as many answers as you wish. Contest blanks are free at all Daylo dealers. All answers must be mailed before midnight, August 1st, 1920.

A-3114



|                         |                   |
|-------------------------|-------------------|
| 1 First Prize.....      | \$3,000.00        |
| 1 Second Prize.....     | 1,000.00          |
| 3 Prizes—\$500.00 each  | 1,500.00          |
| 4 Prizes—\$250.00 each  | 1,000.00          |
| 5 Prizes—\$200.00 each  | 1,000.00          |
| 10 Prizes—\$100.00 each | 1,000.00          |
| 10 Prizes—\$ 50.00 each | 500.00            |
| 20 Prizes—\$ 25.00 each | 500.00            |
| 50 Prizes—\$ 10.00 each | 500.00            |
| 104 Prizes              | Total \$10,000.00 |

Answers will be judged by the editors of "LIFE" and contestants must abide by their judgment.

If two or more contestants submit the identical answer selected by the judges for any prize, the full amount of the prize will be paid to each.

Contest begins June 1, 1920, and ends Midnight, August 1, 1920. Postmarks on letters will determine if letter was mailed before close of contest.

Answers must contain not more than 12 words. Hyphenated words count as one word.

Complete Contest Rules are printed on Contest Blank. Ask Daylo dealers for them.



## Metal Workers This Means Money to You

**The New Metal Worker Pattern Book**—The most complete book on metal pattern work published. It contains 259 problems, 544 pages, size 10x13 inches. No one in the sheet metal trade can afford to be without this book. The major portion is taken up with "Pattern Problems," and is divided into four parts. The first part has to do with parallel forms, r miter cutting, and also has many problems for the c-rnice maker and those who make pipe work.

In the second section, on regular tapering forms, there is a diversified number of problems dealing with such objects as funnels, scale scoops, tapering elbows, roof flanges and so on.

In the third section the science of triangulation is thoroughly expounded, for within the category of irregular forms will be found more objects made of sheet metal than are grouped in the other two classes—parallel or tapering forms combined. In this section on the developing of the patterns by triangulation so many kinds of articles are treated that a complete mastery is assured to those who diligently apply themselves to its study. The solution of every problem that is likely to come up in practice is given.

The fourth section gives the trade the benefit of the short cut methods developed by experts during the past few years.

This one section with its new problems on the development of such modern work as automobile bodies, hoods, fenders, mud guards, etc.; marquees, grain chutes, dust separators, conveyors, duct work, furnace fittings, flanges for flag poles, boxes, blower connections, range canopies, hoppers, spouts, etc., is well worth the price of the book to those who have the former editions.

Price, postpaid, \$7.50.

POPULAR SCIENCE MONTHLY  
225 West 39th Street, New York City

## THE 1920 Motor Annual of the Popular Science Monthly

This big book accurately pictures and describes more than 400 new devices and accessories and contains scores of practical ideas for the Owner, Manufacturer, Dealer and Mechanic.

Everyone interested in automobiles will want this big Motor Annual. The 1920 edition is limited to 100,000 copies. Order now if you wish to make sure of getting a copy.

Price, postpaid, 35 cents

Popular Science Monthly,  
225 West 39th Street, New York

offset or bend should be placed near the bottom of each end of the handle where it passes through a slotted projection on the pail-sides at the top. A small weight should be hung from the bottom of each end of the handle.

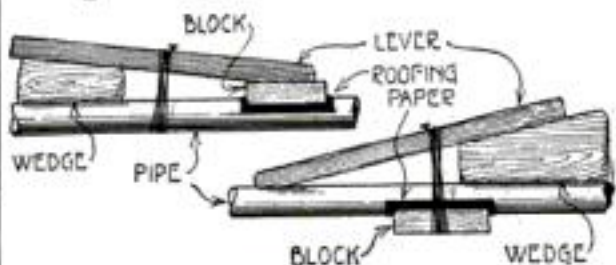
As shown in the illustration, both weights form an integral part of the handle and cause it to move automatically to its vertical position.

## Before the Flood: First Aid for the Leaky Water-Pipe

**T**HE illustration shows a way in which a temporary repair can be made for a small leak in a water-pipe.

The method depends greatly upon the position of the rupture and its accessibility.

Provide yourself with a wooden wedge and a lever of stout wood

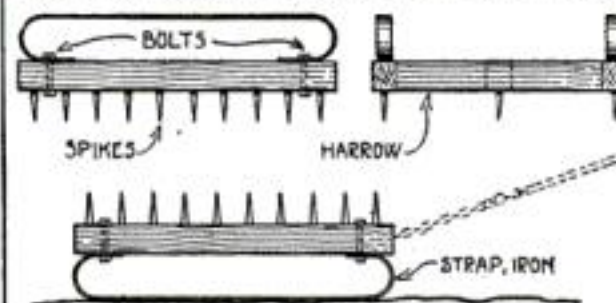


Why wait for the plumber when you have a leaky water-pipe? Make your own repair with wooden blocks

about 2 ft. long. Cover the leak with a strip of roofing-paper, placing cement or tar between it and the pipe. Then over the roofing-paper set a block of wood, with a curve in one face to fit the curve of the pipe. Now, place the lever on the pipe, and strap it down against a second blocking, as shown. This will keep the opposite end of the lever several inches away from the pipe. Driving the wedge between the lever and the pipe applies great pressure to the other end of the lever, and the patch is thus forced over the leak.

## Make Runners for the Top of Your Harrow

**W**HEN the rigid type of spike-tooth harrow is being moved from barn to field, or from one field to another, a wagon or stone boat is usually employed. The accompanying illustration shows such a harrow



If you will attach runners to the top of your harrow, you need only reverse it to haul it away

equipped with strap-iron runners which eliminate the necessity for having a separate vehicle to move it.

The runners are simple to make and easy to attach. Two- or three-in. strap-iron, bent to the shape shown and bolted to the harrow frame, serves the purpose.



# DETROIT

The Auto Center is the  
Logical Place  
To



Training for  
Head and  
Hand

## LEARN AUTO AND TRACTOR BUSINESS

### Earn \$100 to \$400 Monthly

Factories, Garages and Service Stations everywhere are calling for Trained Men in ever increasing numbers. Hundreds of our students are in business for themselves making \$5,000 to \$10,000 and more yearly. There are thousands of valuable locations for Garages and Service Stations everywhere—the field is unlimited.

No matter what you have done or what you are doing now, you can learn

#### Auto Factories Endorse School

The thoroughness of our methods and the completeness of our equipment are well known in the Auto Industry. The biggest factories in the country heartily endorse our Course. In fact, many of the leading Auto Manufacturers assisted in outlining our Course and they give our students the fullest co-operation possible. These factories are constantly calling on us for graduates because they know the type of men we turn out. Everywhere in the Automobile Industry, M. S. A. S. graduates are given the preference because ours is the factory endorsed school.



#### Detroit the Logical Place to Learn

Detroit, with more than 120 Auto and Accessory factories, is the logical place to learn the Auto and Tractor business. 79% of all automobiles manufactured are made in Michigan—71% are made in Detroit alone. Can you think of a better place than the Auto Center in which to learn this business of big opportunities?

#### Courses Thorough and Complete

Each student is taught Auto, Truck and Tractor construction in every detail. We train both the head and hand. There are over one hundred motors of all types in our block test department. Our course in Auto Electrics is very thorough—graduates have no trouble locating any electrical trouble quickly and easily. Students get complete, thorough and practical knowledge of Motors, Starting, Lighting, and Ignition Systems, Carburetion, Lubrication, Transmission, Differentials, etc. As a part of the regular Course, students are given complete and thorough training in the care, repair and operation of Farm Tractors. Brazing and Welding and Tire Repairing are taught in separate Courses. Either of these Courses may be taken separately but if taken with the regular Automobile Course, make a valuable addition to the equipment of any student. To men who want to sell Autos, Trucks and Tractors, this training gives an exceptional advantage for they know just how to judge the value of old machines they are asked to take in trade on new machines. They know these machines as no average salesman can know them. School is open all year—you can start any day.



#### HUDSON MOTOR CAR COMPANY

DETROIT, MICH., U.S.A.

The Michigan State Auto School in our opinion, is the finest institution of its kind in the country. In fact we endorse its method of instruction.

We have recommended a great many students to them and the results were satisfactory.

The Michigan State Auto School ranks highest in the standard of schools. Its equipment and personnel is second to none. This school is thought very highly of by the automobile men of Detroit and is considered one of the most efficient schools in the country.

If you intend to visit any school, then by all means choose the best one. The Michigan State Auto School, so far as we know is the best. You will make no mistake by entering for a course. Yours faithfully,

HUDSON MOTOR CAR COMPANY  
Service Department

#### PAIGE-DETROIT

MOTOR CAR COMPANY  
DETROIT, MICH., U.S.A.

The Michigan State Auto School bears a very good reputation and we believe turns out good workmen. At present time there seems to be no difficulty for their graduates to secure positions. Very truly yours,

PAIGE DETROIT MOTOR CAR CO.  
W. A. Wheeler, Factory Manager

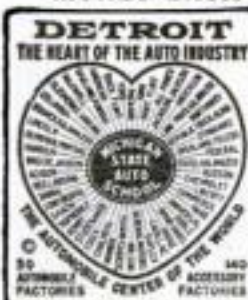
#### Hupmobile

Hupp Motor Car Corporation  
DETROIT, MICHIGAN, U.S.A.

Having had the pleasure of recently visiting and inspecting most carefully your school, permit me to say that I was deeply impressed with the personnel of your organization, the equipment that you have and the methods you use to teach your students. Yours very truly,

HUPP MOTOR CAR CORPORATION  
D. E. Salisbury, Manager Service Department

#### READ THIS MONEY-BACK GUARANTEE



We guarantee to qualify you for a position as chauffeur, repair man, demonstrator, auto electrician, garage man, automobile dealer or tractor mechanic and operator paying from \$100 to \$400 monthly, or refund your money, provided you do your part and attend our classes.

#### DETROIT IN SUMMER

In addition to being the heart of the Automobile Industry, Detroit in summer is the center of some of the finest pleasure spots in America. Detroit has 38 parks, the finest of which is Belle Isle—a wooded island in the Detroit River, said to be one of the most beautiful spots in America. Here you find boating, bathing and a score of other amusements within a few minutes boat or trolley ride of the heart of the city. Then there are daily boat trips up and down the Detroit River, through Lake St. Clair,—across Lake Erie to Toledo, Cleveland, Buffalo and Niagara Falls; trips to Sugar Island and to Put-In-Bay where you may explore the caves in which Commander Perry hid his men from the British Fleet in the War of 1812. During the summer months many pleasant evenings may be spent enjoying the cooling breezes from the deck of a boat as it glides through the moonlit waters. Already the Michigan State Auto School has arranged for three of these boat trips for this summer. These are free to students and their friends. At all times throughout the year Detroit is the logical place to learn the Auto and Tractor business, but the summer attractions in and around Detroit make June, July, August and September ideal months in which to get this training and at the same time enjoy Detroit.

#### Big 176-Page Catalog

Send the coupon today for the 176-page Catalog and copy of latest "Auto School News" both absolutely FREE. They tell about Courses—show more than a hundred pictures of equipment—give letters from big Auto Factories and Graduates. M. S. A. S. Courses are as reasonable in price as they are thorough in their training. Those who have jumped on a train and come to Detroit to investigate our school, have found the Courses so satisfactory and so reasonably priced that they have remained to get the M. S. A. S. Training. Our Money-Back guarantee protects you. If you can't come, get the catalog. Resolve to learn the business in Detroit—The Heart of the Auto Industry. Use the coupon NOW.

#### Not a One-Man School

This school is founded on the best, newest and most practical principles in the Auto, Truck and Tractor business. Our Course is built with the closest and most liberal co-operation from Manufacturers, Garages, Service Stations and Owners. It is not one Man's ideas, but the combined ideas of the biggest and most successful men in each field.



#### SEND THIS COUPON TODAY

MICHIGAN STATE AUTO SCHOOL

586 Auto Bldg., 687-89-91 Woodward Ave., DETROIT, MICH.

GENTLEMEN:

Please send me, absolutely FREE New 176-page Illustrated Catalog, "Auto School News," and information as checked below.

☐ Auto and Tractor Course

☐ Tire Repairing

☐ Brazing and Welding

(Mark each course you are interested in) or, better still, you can expect me about

Name .....

Street .....

City..... State.....

## MICHIGAN STATE AUTO SCHOOL

"Most Progressive Auto School in America"—"In the Heart of the Auto Industry"

586 Auto Building  
687-89-91 Woodward Ave.

DETROIT, MICH., U.S.A.





## "and from there we went to Japan

Talk about adventures!

Men in the Navy come home with the kind of experiences that most chaps read of only in the books.

Here's your chance!

Uncle Sam has, as you know, a big Navy and gives red-blooded young fellows like you an opportunity to step aboard and "shove off".

What will you get out of it?

Just this:

A chance to rub elbows with foreign folks in strange parts of the world.

The chance for good honest work on shipboard—the kind of work that teaches you something real; the kind of work that puts

beef on your shoulders and hair on your chest.

You will get 30 care-free vacation days a year, not counting shore leave in home or foreign ports.

You will have the kind of comradeship in travel that sailors know.

You will have regular pay, over and above your meals, lodging and your first uniform outfit—good stuff all of it.

You can join for two years. When you get through you'll be physically and mentally "tuned up" for the rest of your life. You'll be ready through and through for SUCCESS.

There's a Recruiting Station right near you. If you don't know where it is, your Postmaster will be glad to tell you.

To any Father and Mother:—

*In the Navy your boy's food, health, work and play, and moral welfare are looked after by responsible experts.*

# Shove off! - Join the U.S. Navy

## The Real Estate Educator

By F. M. Payne. Contains The Federal Farm Loan System, How to Appraise Property, How to Advertise Real Estate, The Torrens System of Registration, Available U. S. Lands for Homesteads, The A B C's of Realty, Mechanic's Lien, Workmen's Compensation Act, Income Tax Law, Employer's Liability Act, Statute of Frauds, How to Sell Real Estate, How to Become a Notary Public, How to Write Fire Insurance, and other useful information. 208 pages, cloth. Price postpaid, \$1.50.

POPULAR SCIENCE MONTHLY

225 West 39th Street, - - - New York



## RUNS ON KEROSENE ALCOHOL OR GAS ANYWHERE

Genuine comfort and relief in the heat day and night may be yours with one of these remarkable non-electric fans. Every home and office needs one for health and efficiency. This fan is ideal for the sick. It is a proved success, quiet and convenient and runs anywhere at almost no cost without electricity, springs or wires. Sixth season. Three models. Three sizes.

BE WELL—KEEP COOL

LAKE BREEZE MOTOR

581 West Monroe St., - - - Chicago

## Are You Interested in Electricity?

Easy Electrical Experiments and How to Make Them. By L. P. Dickinson. 220 pages, 110 illustrations, 12mo, cloth. 1918 Edition. Price, \$1.25.

The many and varied purposes for which electricity is now used makes it necessary for every young man of today who would succeed in any mechanical line to have a good working knowledge of its principles, and in this volume the author has made an easy attainment of this knowledge possible.

It is valuable for the amateur or practical electrician. It gives in easily understood language everything one should know about galvanometers, batteries, magnets, induction coils, motors, volt-meters, dynamos, storage batteries, simple and practical telephones, telegraph instruments, rheostats, condensers, electrophorus, resistance, electroplating, electric toy-making, etc.

Handy Vest-Pocket Electrical Dictionary. By Wm. L. Weber, M. E. Cloth, red edges, \$0.35; leatherette, red edges, \$0.75.

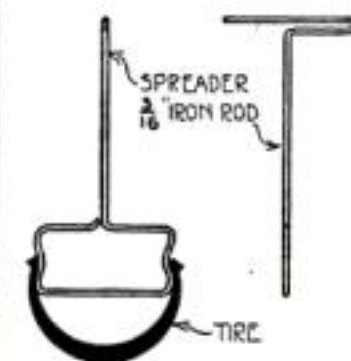
Contains upward of 4,800 words, terms and phrases employed in the electrical profession, with their definitions given in the most concise, lucid and comprehensive manner. It also embodies many of the features of the cumbersome volumes of electrical encyclopedias, which are only accessible in public or private libraries, and which, by reason of their ponderous dimensions, are rendered impossible as aids to the average electrician in the daily routine of his profession.

POPULAR SCIENCE MONTHLY

225 West 39th Street, - - - New York

## A Tire-Opener Gives the Motorist a Third Hand

WHEN changing tires it is often desirable to hold the shoe open or to spread it so that it may be inspected or repaired. As a person has only two hands, this operation is often awkward and difficult to manage. A



The opener is inserted lengthwise; then given a twist, which opens the casing for inspection

tire-spreader like the one shown in the sketch, will help matters.

Have a blacksmith make the spreader out of round 3-16 in. iron rod. The spreader part should be just long enough to open the shoe

without straining it. The handle should be turned at right angles to the spreader to make the operation easier.

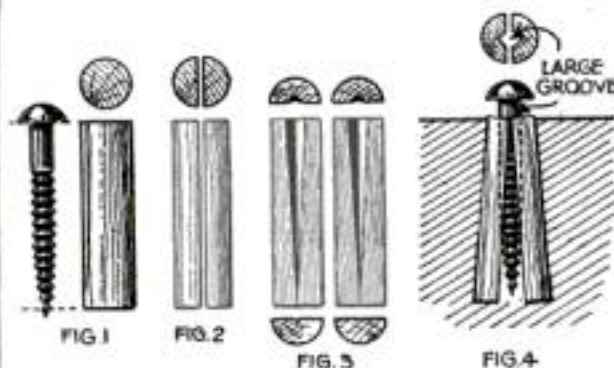
Smooth off all rough projections with fine emery-paper. If possible, have the rod galvanized to prevent its rusting.—R. LAWRENCE.

## To Make a Screw Hold in Plaster

AN easy and cheap anchor for a screw is a small piece of soft wood about the size of a pencil.

Cut this piece of wood down to form a pin so that its diameter will be a little larger than the screw to be used. The pin length must be a little shorter than the length of the screw, as shown in Fig. 1.

Split the pin down the middle (Fig. 2) and file a groove on one half, deep at one end and diminishing into a mere scratch at the other (Fig. 3). File a



Metal screws will mutilate a plaster wall if inserted in the ordinary way. A wooden plug will hold them firm without damage to the wall

similar tapering groove on the other half. Make a hole in the wall, take the wood pin, apply a little glue to its end, and hammer it into the wall so that the large groove will be facing you. Now take a screw and insert it into the end of the pin and screw it into the peg in the ordinary way (Fig. 4). As the screw advances into the wooden peg and reaches the shallow groove, it will spread the base of the plug and form a tight wedge in the wall.—M. TOCABEN.



## Growing Potatoes in a Pen Saves Garden Space

**G**ROWING Irish potatoes in a pen is the city dweller's latest device for increasing his food supply. W. E. Ashley, of Greensboro, N. C., has devised a method capable of producing forty bushels of "spuds" in the "jamb of a fence" within two months.

The invention somewhat resembles a pig-pen. Two hundred feet of 2 by 4 scantling, 4 bundles of wheat-straw, 100 lbs. of fertilizer, and 4 tons of soil are the necessary materials.

The arrangement determines the success or failure of the practical potato-pen. The end-pieces of both edges are gained, except the two



In these high-cost-of-living days, backyard soil is at a premium. Growing potatoes in a pen sounds funny, but here's the way to do it and get results

bottom sills. These are shaved on one side only, the rough edges being placed on the ground. The margin of space between the inside edges of the gains is 6 ft.

The side-pieces are gained on one edge only, 8 ft. between the insides of the gains; all gains are  $\frac{1}{4}$  in. deep. Care should be exercised not to hew them too deep, as there should be at least 3 in. between the scantling on both the sides and the ends of the pen.

On a level foundation are placed two end-pieces that are gained on one edge only. Two side-pieces are supplemented and filled in with 6 in. of soil; to which is added 15 lbs. of fertilizer. Then the first row of seed is started 6 in. from the inside of one end, placing the other seed in this row 1 ft. apart.

The second row is started from the same end and the first seed is put 12 in. from the inside. By planting the remainder of the seed in that row 12 in. apart, the hills are staggered like a checkerboard—45 seed in each bed. On this bed is scattered 6 in. of wheat-straw, which is wet down thoroughly.

Next, a set of scantlings is placed all around and filled in with 6 in. of soil. It is fertilized as was the first bed. The planting is started in the first row 12 in. from the same end as the initial layer so as to provide as much growing space as possible in the pen. Set in good soil, well fertilized and kept moist, the potatoes will mature in two months.

As to the labor required to put up a pen, a good worker can easily do it in a day and a half. The average business man could complete a pen in two days.



## What is Happiness?

**M**ORE than anything—it is health, the heritage of nature. Strong men and women can smile at the trials of life, for they have the strength and stamina to weather reverses and win to success.

It is impossible to estimate how much the bicycle has contributed to the happiness of America. It is the "Open Sesame" to a world of healthful delights. It is the magic tonic that has built the foundations of health and character for millions. It is the most pleasant form of exhilarating exercise. Thousands of men and women ride bicycles for convenience, pleasure, health and economy.

To own a bicycle is the one big desire in the heart of every girl and boy. It means the most perfect of all happiness to them.

Be happy—ride a bicycle.

See your dealer today.

CYCLE TRADES  
35 Warren Street,



OF AMERICA, Inc.  
New York, U. S. A.

# Ride a Bicycle





## Home Study Business Courses

Do you want an important, high-salaried position? You can have one if you can do the work. LaSalle experts will show you how, guide you step by step to success and help solve your personal business problems. Our plan enables you to train during spare hours without interference with your present duties. Give us your name and address and mark with an "X" below the kind of position you want to fill. We will mail catalog and full particulars regarding our low cost monthly payment plan. Also our valuable book for ambitious men, "Ten Years' Promotion In One." Tear out and mail this advertisement today. No obligation to you. Let us prove to you how this step has helped thousands of ambitious men to real success.

-----Coupon-----

- ☐ **HIGHER ACCOUNTANCY:**  
Training for positions as Auditors, Comptrollers, Certified Public Accountants, Cost Accountants, etc.
- ☐ **BUSINESS ADMINISTRATION:**  
Training for Official, Managerial, Sales and Executive Positions.
- ☐ **TRAFFIC MANAGEMENT—FOREIGN AND DOMESTIC:** Training for positions as Railroad and Industrial Traffic Managers, etc.
- ☐ **LAW:**  
Training for Bar; LL.B. Degree.
- ☐ **COMMERCIAL LAW:**  
Reading, Reference and Consultation Service for Business Men.
- ☐ **PRODUCTION EFFICIENCY:**  
Training for Production Managers, Department Heads, and all those desiring training in the 48 factors of efficiency.
- ☐ **BUSINESS LETTER WRITING:**  
Training for positions as Correspondents, Mail Sales Directors, and all executive letter-writing positions.
- ☐ **BANKING AND FINANCE:**  
Training for executive positions in Banks and Financial Institutions.
- ☐ **BUSINESS ENGLISH:**  
Training for Business Correspondents and Copy Writers.
- ☐ **COMMERCIAL SPANISH:**  
Training for positions as Foreign Correspondent with Spanish-speaking countries.
- ☐ **EXPERT BOOKKEEPING:**  
Training for position of Head Bookkeeper.
- ☐ **EFFECTIVE PUBLIC SPEAKING:**  
Training in the art of forceful, effective speech for Ministers, Salesmen, Fraternal Leaders, Politicians, Clubmen, etc.
- ☐ **C. P. A. COACHING FOR ADVANCED ACCOUNTANTS:** Prepares for State Board and Institute Examinations.

**LaSalle Extension University**

The Largest Business Training Institution in the World

Dept. 683-R Chicago, Illinois



[Name]

[Present Position]

[Address]

## An Easily Made Vise Attachment

By R. H. Casper

IN the accompanying illustrations is shown an attachment whereby a number of pieces of varying thickness may be held in a vise simultaneously and each with the same pressure. This is a decided time-saver, especially on planer or shaper work when a number of pieces are to be planed to the same height. A pressure on any

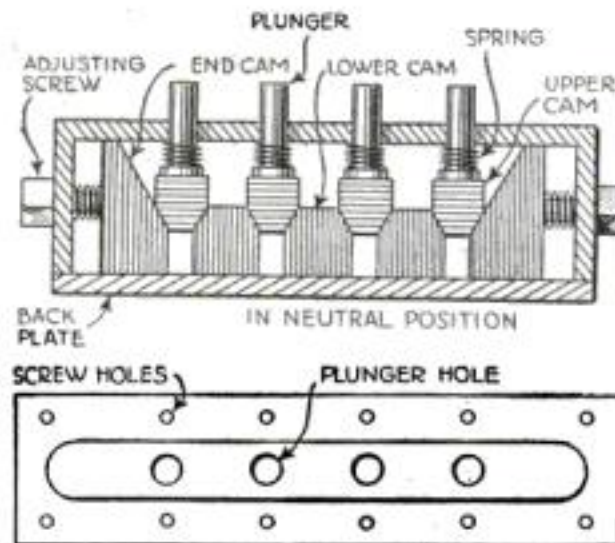


FIG. 1 BACK VIEW OF OUTSIDE CASE WITH BACK PLATE REMOVED

By turning the adjusting-screws in or out, you can adapt the plungers to practically any combination of surfaces

one plunger causes the other three to move out; a pressure on two plungers causes the other two to move out; and so on. As each plunger depends upon its neighbor for its pressure, it is evident that the pressure on all will be equal.

The back plate is held on by counter-sunk screws which are not shown in the illustration.

In order to increase the capacity of the attachment, adjusting-screws are placed on each end. By turning these screws in or out, as needed, the plungers will adapt themselves to practically any combination of surfaces within the capacity of the attachment. (Fig. 1.)

In Fig. 2, which shows the attachment in operation, the adjusting-screws have been somewhat withdrawn. The springs return the plungers to the neutral position as soon as the pressure is released. The details of the internal mechanism also are shown in this figure.

If the ends of the plungers are fitted with ball-jointed feet, curved surfaces, or surfaces not parallel with the vise jaws, may readily be held.

The construction of such an attachment is not as difficult as it may at first appear. The outside case shown in the illustration was made from a block of cast-iron. It was first drilled at each end with a drill equal in diameter to the thickness of the cams. The holes thus made were given a depth equal to the height of the end cam. The metal between the two holes was then removed with an end-mill on a milling-machine.

The home worker, not having a milling-machine at his disposal, must proceed in a slightly different manner. Instead of only two holes, it is necessary for him to drill a series of holes, all on the center-line of the block, and so spaced that each hole will break into the adjoining one. These holes must be drilled all the way through the block. The metal which is left between the drill holes is then chipped out, and the slot, thus produced, is smoothed with a file. This method necessitates fastening a plate to the front of the attachment. The plate is the same as the back plate, except that it is drilled for the plungers. Since all the pressure is against the back plate, which is supported by the vise-jaw when in operation, there is no danger of the front plates being forced off.

The sliding cams are made by cutting rectangular pieces of steel, of the required thickness, and filing off their corners to the required angle. An angle of  $120^\circ$  as shown in Fig. 2, will give the best results. If the four upper cams, or the three lower cams, are clamped together in the vise while being filed, they will all be brought to the same dimensions.

The end cams are made in the same manner, except that the ends are rounded. This rounding permits them to be withdrawn to the extreme ends of the slot.

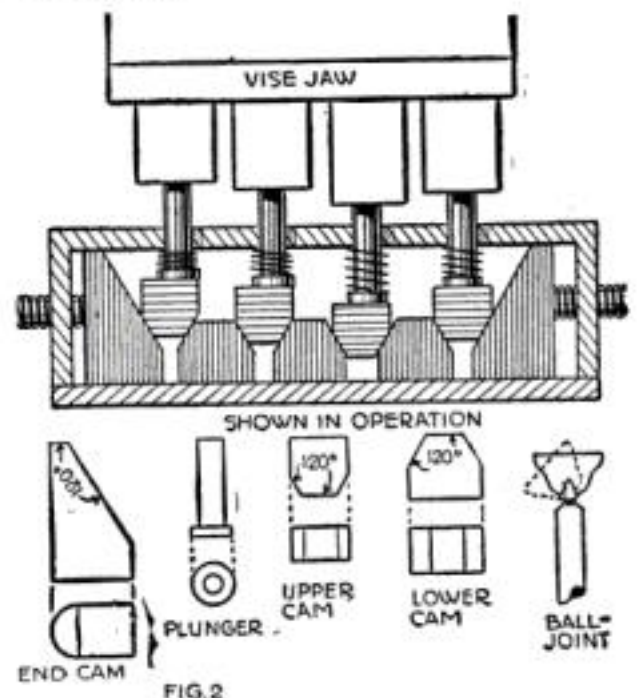


FIG. 2 Here are shown the details of the internal mechanism. The construction of this apparatus is not difficult or costly

If a lathe is at hand, the plungers may be made by turning two of them from one bar and then cutting them apart. As the shape of the plunger head is immaterial, ordinary hexagon-head cap-screws may be used for plungers by reducing the heads and filing them flat on top.

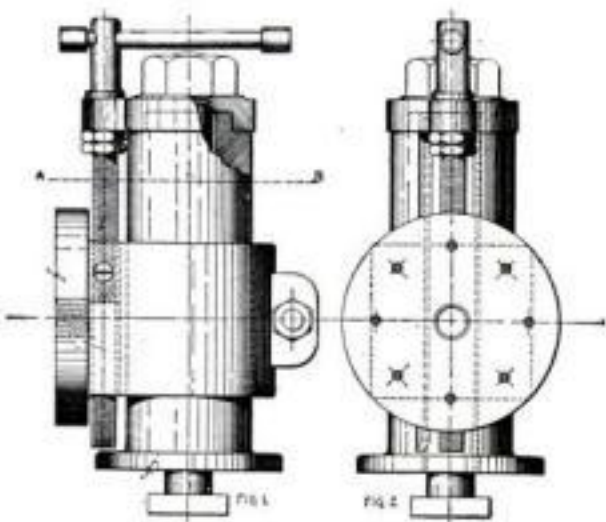
A generous supply of thick grease should be inserted into the case before attaching the back plate, with all parts well oiled.



## How to Make a Lathe-Milling Attachment

THERE are many milling attachments for small lathes, but most of them require sliding ways which must be milled or planed and require accurate fitting, often beyond the capabilities of the amateur equipped only with a small screw-cutting lathe. Here is a milling attachment of very simple construction to be used where the work must all be performed on the lathe and bench.

It is to be bolted to the tool slide of the lathe, and the work to be milled is attached to it, the cutters being rotated in the lathe-chuck or other holder. Longitudinal and transverse feed is given the work by the tool slide, while the vertical adjustment is made by a slide that moves up and down on a vertical column, this being cylindrical, instead of having V- or



The slide carries an adjusting screw as shown in Fig. 1. Fig. 2 is a front view

flat slides, in order to allow of its construction on the lathe.

The face of the slide is circular, turned off smoothly, and mounted on an angle-plate on the lathe-face plate. A  $\frac{5}{8}$ -in. hole is drilled and tapped in the center, in order to hold an angle-plate (as shown in Fig. 6) or to take a lathe-chuck adaptor (made as in Fig. 5). Ordinary work, such as plates or shafting, is best held by one clamp or a pair of small clamps (Fig. 7). A clamp is made in two sizes, and is provided with a counter-sunk hole in the base to hold a machine-screw for holding it down. A series of holes may be drilled and tapped around the surface of the milling fixture slide, to hold the clamps in any desired position; a pair of them will hold a shaft or bar very firmly. Cylindrical work is held in a lathe-chuck screwed to the adaptor (Fig. 5), while some work is best held by an angle-plate, which can be bought and drilled for the bolt, cast from a pattern and file-finished, or even built up of two steel plates.

The upright is a steel or cast-iron column cored out or drilled for a long bolt to clamp it to the tool slide. A cast-iron cap fits over the top, and is held in place by a short key and the nut on top. It is provided with a



*Teach Them  
To Say  
"Hires"*

**H**IRES is good for all ages—at all times. Every one of the sixteen Hires ingredients is a product of Nature from the woods and fields, collected from all parts of the world.

*Nothing goes into Hires but the pure healthful juices of roots, barks, herbs, berries—and pure cane sugar. The quality of Hires is maintained in spite of tremendously increased cost of ingredients. Yet you pay no more for Hires the genuine than you do for an artificial imitation.*

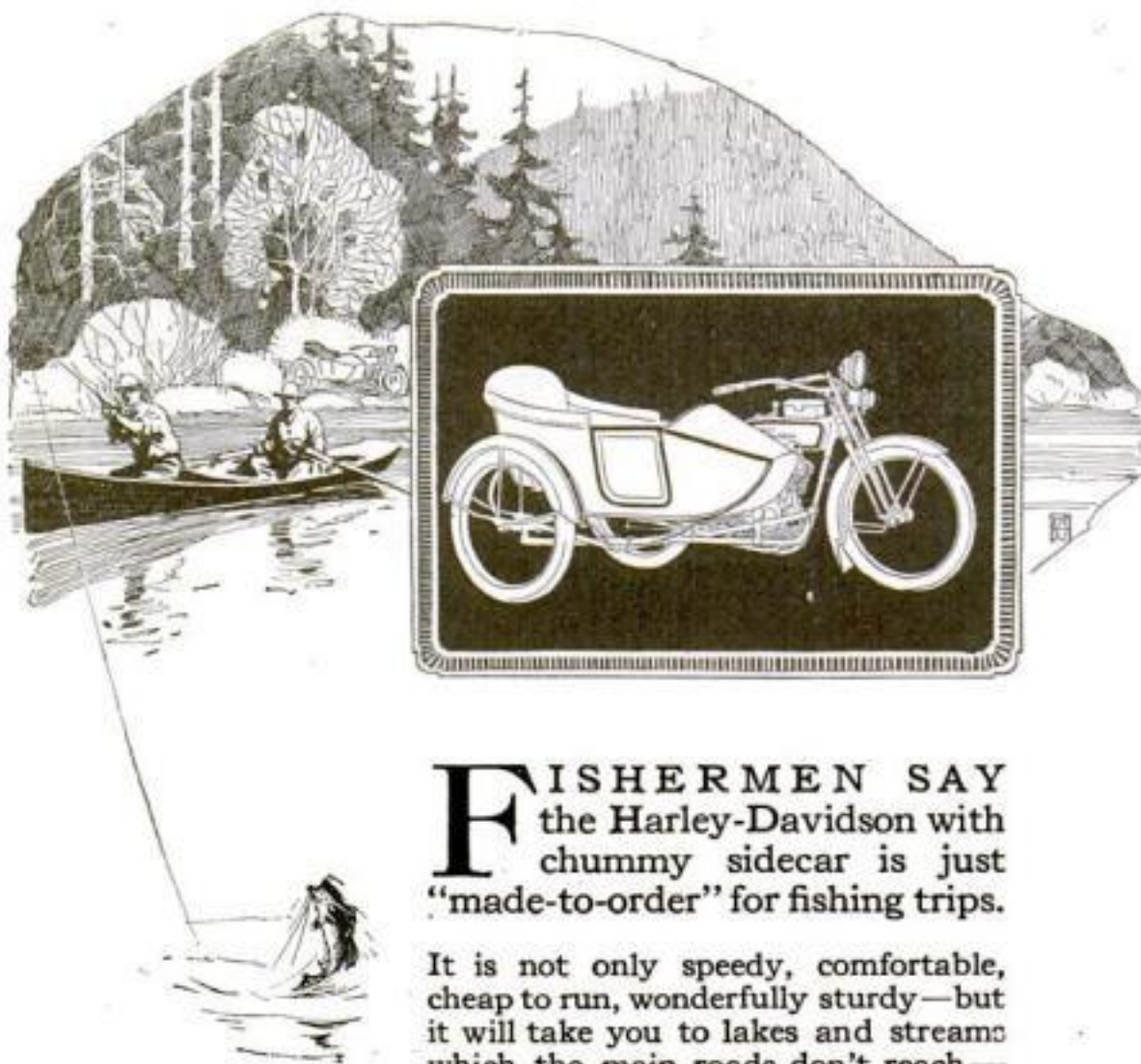
But be sure you say "Hires" to get Hires. At fountains, or in bottles, at your dealers. Keep a case at home and always have Hires on ice as first aid to parched palates.

THE CHARLES E. HIRES COMPANY, PHILADELPHIA

# Hires

*Hires contains juices of 16 roots, barks, herbs and berries*





**F**ISHERMEN SAY the Harley-Davidson with chummy sidecar is just "made-to-order" for fishing trips.

It is not only speedy, comfortable, cheap to run, wonderfully sturdy—but it will take you to lakes and streams which the main roads don't reach—hidden waters where fish are plentiful and fishermen scarce. Paths are highways to the Harley-Davidson!

Forty to sixty miles on a gallon of gasoline, with other running costs low in proportion—and speed to spare!

Ask Your Dealer About His Easy Payment Plan

HARLEY-DAVIDSON MOTOR CO.  
MILWAUKEE, WISCONSIN

# Harley-Davidson

"World's Champion"

## DRIVER AGENTS WANTED

116-inch Wheel Base 158-inch Spring Suspension  
5-Pass. Touring  
To drive and demonstrate 1929, 4-cyl., 37 H. P. BUSH Car—Timken Bearings—Willard Batteries—2-Unit Ste. & Lag.—Full Floating Axel. Write at once for the best Automobile Offer in existence—don't wait—prompt shipments. Money-back guarantee.  
**BUSH** Address J. H. Bush, President, Dept. F111, MOTOR CO., Bush Temple, Chicago, Illinois

**Oh Boy! Build This Car**  
This nifty little car driven by gasoline motor, can be built by any boy. Parts are furnished by us and are very cheap. Send 26c for building plans and price list of parts showing how to build this lad's car.  
**SYNPER MFG. CO., 174 Synper Bldg., Toledo, Ohio.**



**Factory**  
price direct to you  
This \$12 Officer Shoe  
Hand sewed. \$6.89  
First Grade.  
The factory price direct to you at only

The retail price of this shoe is \$12.00. It is made of the best waterproof mahogany calf leather. Guaranteed to give the best wear. If these shoes are not just as we say, send them back. You don't lose a cent.

If you are sending money order or check do not include postage. Pay only \$6.89 for shoes. We pay postage. State also.

These shoes are built to be good for work and dress at the same time.

**U. S. National Army Shoe Co.**  
Dept. P. M. 795, Westfield, Mass.

## AN EASY WAY TO MAKE MONEY

Don't be content to plod along on a small salary. Be independent. Go in the tire repairing business. One man says "I made \$50.00 the first day." Others average \$200 to \$500 a month. Very little capital needed. Jobs plentiful. Every motorist a possible customer. No experience needed. We teach you.

### SHALER Tire Repair Outfit

Improved Wrapped Tread Method  
Used by Tire Manufacturers

Does as good work as the big high priced vulcanizing outfits. A boy can use it. It's the only vulcanizer that has Automatic Heat Control, and can't undercure or overcure a tire. Requires no watching or regulating.

### FREE Book

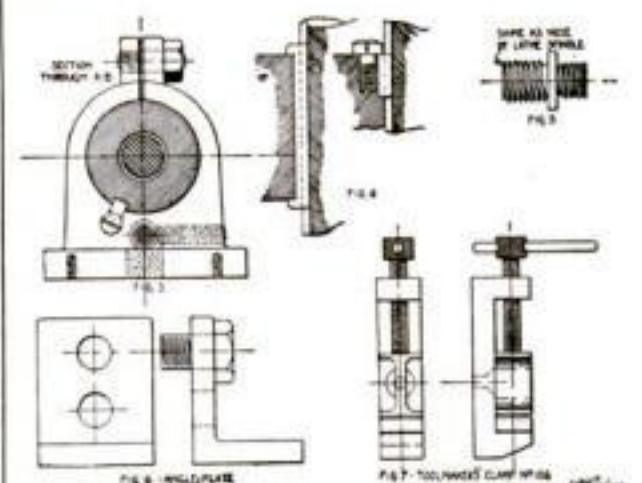
"How to Open a Tire Repair Shop." It tells how to make big money. Don't delay. Write quick.

**C. A. SHALER CO.**  
2165 Fourth St. Wausau, Wisconsin



boss for the adjusting screw and handle. The long keyway may be made by first drilling a series of shallow holes and then setting the column between lathe centers, and with the lathe tool over on its side in the tool-post, shaping the keyway by running the tool-post back and forth by hand. Fig. 4 shows two methods of fitting the key in the slide. The best way is to use a long hooked key, but this necessitates filing and chipping a keyway the whole length of the slide. An easier way would be to chip a short keyway, fit a key of the same length, and hold this in place by a machine-screw, as shown.

After boring out, the slide is slit with a hacksaw and the clamping bolt fitted. The adjusting screw may be tapped directly into the slide casting, but it would be better to bore a hole larger than the screw, drive in a bronze or gun-metal bushing, tap this to fit the screw, and hold it in place by



Figs. 3, 4, 5, 6, and 7 show how the parts will appear when finished. No part of the work is difficult

means of a set-screw, as in Figs. 1 and 3. Any kind of a handle can be used on the end of the adjusting screw; the type shown in Fig. 1 is easily made and not in the way.—H. H. PARKER.

## You Can't Have Eggs and Mites at the Same Time

**P**OUULTY men and farmers sometimes overlook a very important fact; that even the best of feed, plentiful and well-balanced, will not induce hens to lay eggs if they are compelled to roost in houses infested with mites.

These little red insects sap the vitality of the hen by sucking her blood. Hens have been killed, virtually eaten alive, by mites. Chickens cannot lay except when their vitality is maintained. Vitality and mites cannot exist in the same hen-roost.

At the first sign of warm weather guard against mites by giving all wood-work inside the poultry-house a coat of hot whitewash, well carbolized.

The roosts and their supports should be painted all over with carbolineum, zenoleum, carboline, or kresol. These are all similar products, called by different names by different manufacturers. They are cresol or tar-oil disinfectants, and are death to mites, while in no way injurious to the chickens.



## Make a Support for Spark-Plug Wires

ON some cars the wires or cables leading from the distributor to the spark-plugs are left dangling loosely, so that they come in contact with the engine and other parts and become chafed until a short-circuit or ground occurs. Besides, they drag on the plug clips and look decidedly untidy.

Make a support or bracket for these cables from a piece of hard fiber not less than 18 in. thick, with holes for the cables just large enough for the cables to fit tightly and without slipping. Round off the edges of the holes to avoid cutting. If the wires are long and heavy, make the holes a little larger, and wind a couple of turns of tape around each wire where it passes through. Rivet the fiber to an L-shaped bracket of sheet-iron or brass, and drill a hole for a cylinder-head screw or any other screw or bolt that is in a convenient place for the purpose.



Oil-soaked wires are bound to short-circuit. Why not prevent them from getting into the grease, in this manner?

This arrangement makes a surprising difference in the life of the cables, as well as in the appearance of the power plant.

## An Alligator Wrench You Can Make at Home

THE accompanying illustration shows an alligator wrench that is much more efficient than the regular type. The advantage lies in having



This new style home-made alligator wrench affords a tight grip on the bolt or pipe, and does not mutilate the metal

the handle virtually form a continuation of the smooth side of the jaws. Therefore the notched side of the jaws draws directly toward the main part of the nut instead of away from it, and great pressure makes it grip

tighter, instead of mutilating the corners of the nut and then slipping off, as the old-style wrench does.

The average mechanic will not find this wrench hard to make. The one illustrated was made from pieces of spring-steel about  $\frac{5}{8}$  in. in diameter, and from 12 to 15 in. long, flattened out until about  $\frac{1}{4}$  in. thick. The notches can be made best by first cutting them the desired depth (about  $\frac{1}{8}$  in.) with a hack-saw, and then finishing them with a three-cornered file. This notched part is then bent around to the proper shape, and the wrench tempered, in oil.—M. L. DODSON.

# He Earns \$50 a Week Repairing Autos!

THOUSANDS of men on farms everywhere are doing the same. Many are getting more than this. Some are opening garages of their own. Why don't you get into the auto game too? Thousands of men without any mechanical ability have doubled their earnings after getting into the fascinating field of auto construction and repairing. Ten times the number of men now engaged in the business are needed. Fine, big paying jobs are waiting for men who "know" to fill them. Read below and find out how you can fit yourself to hold one of these big, man's size jobs in your spare time, without going away from home at a cost of only 7c a day.

## Learn at Home

No need to pay for an expensive course that will take you away from home. You can learn the auto game at a cost of one-tenth the expense of going away to school. You don't have to serve an apprenticeship either. Use spare time only and keep right on with your present work. This Library of Automobile Engineering and Tractor Information will make an expert out of you and fit you for the biggest kind of job. It is six thick volumes, with 2600 pages and 2300 pictures, plans, diagrams and blueprints, etc. Every part of every well-known car is explained. They teach you everything the best auto schools teach.



## Only 7c a Day

It will only cost you 7 cents a day to own these great money-making books that fifteen great auto and tractor engineers prepared for men just like you. You don't have to know a thing about cars to understand them. Every page is written in plain, everyday language and they begin right at the beginning. With every set we give FREE a consulting membership in our society. You can write our engineers any time and get their help on any proposition on which you get stuck.

## FREE Examination!

to use them as if they were your own. Give them every test you can think of. Take them to your shop. Show them to your friends and ship them back at our expense if you don't want to keep them. If you do keep the books to help you earn more, send us only \$2.80. You can send the balance of \$24.80 price the same way—\$2.00 each month.

Only 7c a day. This is your chance to double your earnings—earn two dollars in the same time it takes to get one now. The coupon is your start.

MAIL  
COUPON  
TODAY



## Everything About Autos

Automobile Motors; Welding; Motor Construction and Repair; Carburetors and Settings; Valves; Cooling; Lubrication; Fly-Wheels; Clutch; Transmission; Final Drive; Steering; Frames; Tires; Vulcanizing; Ignition; Starting and Lighting Systems; Shop Kinks; Commercial Garage Design and Equipment; Electricity; Storage Batteries; Care and Repair of Motorcycles; Commercial Trucks; Gasoline Tractors.

128 Blueprints of Electric Wiring Diagrams

## AMERICAN TECHNICAL SOCIETY Dept. A-20a, CHICAGO, U. S. A.

Please send me the 6-volume set of Automobile Engineering for 7 days' examination, shipping charges collect. If I decide to buy, I will send \$2.80 within 7 days and balance at the rate of \$2.00 a month until \$24.80 has been paid. Then you will send me a receipt showing that the set of books and the Consulting Membership are mine and fully paid for. If I want to get along without the books, I will notify you after 7 days to send for them at your expense.

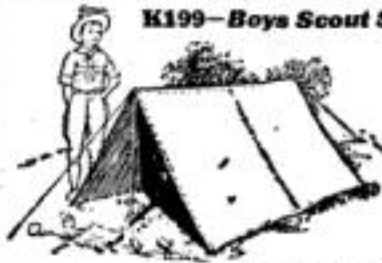
Name .....  
Address .....  
City ..... State .....  
Reference .....  
Please Fill Out All Lines



## Bargains in Army Goods

Order direct from this advertisement and get our **Special Low Price!** Our Money-Back Guarantee Protects You. We Pay Transportation Charges. Order Today!

### K199—Boys Scout Shelter Tents.



Genuine shelter or "pup" tents used by Yanks in France. Just the thing for hunters, campers, hiking trips. Waterproof. Complete with poles, etc. price delivered **\$3.75**

### K100—Turo-Camp Tents



Very fine Olive Drab Army Duck. Almost good as new. Comes in two sections. But toned together making tent 7x12 with 2 1-3 ft. sidewalls. Half section can be attached to auto. Complete with poles as shown in the above illustration. price delivered **\$28.00**

### K101—One section complete with poles. price delivered \$14



**K104—Olive Drab Army Duck Wall Tents.** Almost good as new Splendid bargains, made in four sizes with 2 ft-6 inch walls. (write about other sizes) 7-ftx7-ft. price delivered **\$15.90**



**K99—U.S. Pyramidal Tent, Khaki color.** Size 16 ft. sq; 3 ft. side walls; 11 ft. center. In splendid condition. Wonderful for touring, camping, summer use. Complete with poles and stakes. price delivered **\$42.75**



**K156—Steel Trench Helmet.** Direct from France. Fine souvenir of the world war. Fine for flower baskets, jardiniere, etc. price delivered **97c**



**K108—Army Canteen.** Canvas covered with straps. Used, but watertight. For hunting, fishing, outing trips. price delivered **55c**



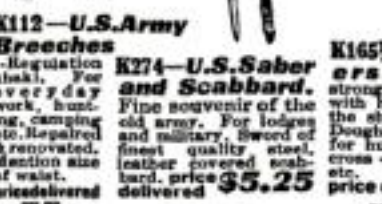
**K203—Army Courier Bag.** Made of heavy quality leather. Used in France by runners and motorcycleists in carrying messages to the front and headquarters. For bank messengers, boy scouts, collectors, hunters, etc., etc. price delivered **\$2.95**



**K237—Army Mess Kit.** Made of aluminum. Tight fitting cover. Combination frying pan and plate. Just the thing for boy scouts, campers, and hunters, etc. price delivered **85c**



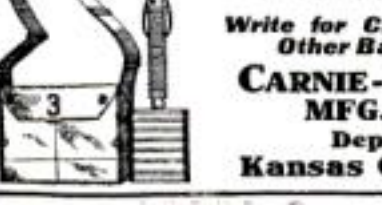
**K225—Miner Tents.** Very popular with campers, hunters, auto tourists and others. Made from army shelter tents. Size 7 ft. x 7 ft. x 6 ft. high in center. Complete with poles and stakes. price delivered **\$9.65**



**K112—U.S. Army Breeches.** Regulation khaki. For every day work, hunting, camping, etc. Repaired & renovated. Mention size of waist. price delivered **75c**



**K274—U.S. Saber and Scabbard.** Fine souvenir of the old army. For lodges and military. Sword of finest quality steel, leather covered scabbard. price delivered **\$5.25**



**K165 1/2—Army Haversack.** Extra strong Olive Drab canvas with harness to go over the shoulders. Used by Doughboys in France. Fine for hunters, tourists and cross-country walkers, etc. price delivered **95c**



**K137—Olive Drab Blankets.** Reclaimed by government methods. Practically like new. Genuine wool. For camping and touring. price delivered **\$5.75**



**K134—Cartridge Belt.** Made of strong khaki webbing. A convenience for every hunter and camper. Nine pockets for shells, tobacco, etc. price delivered **45c**



**K157—Gas Mask.** Used by American troops in Verdun sector. A relic of the great war. Complete with carrying case. price delivered **\$1.42**

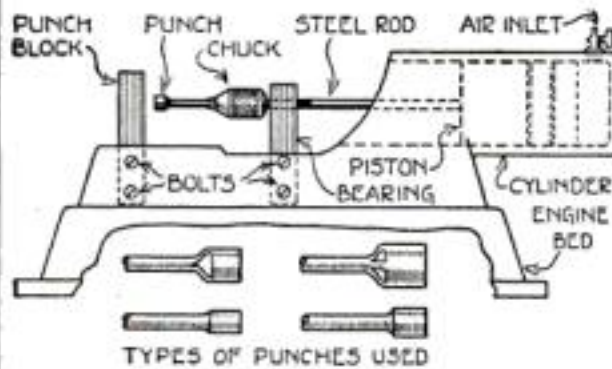
Write for Catalogue of Other Bargains.

**CARNE-GOUDIE MFG. CO.**  
Dept. K.  
Kansas City, Mo.

## A Pneumatic Punch Made from an Old Gas-Engine

IN a garage where it was necessary to cut many washers from leather, fiber, and rubber, an old stationary gas-engine was made into an efficient punch that saved much time and annoyance. The engine was of the horizontal, water-cooled type, of 1 1/2 horsepower.

This was stripped of its fly-wheels, water-jacket, cams, and other mechanism, leaving only the cylinder and base-block. The piston was removed and new rings put in place to seat well. The connecting-rod was then removed and a 1/2 in. steel rod made with the necessary connections to take its place. Across the bed and 6 in. from the open end of the cylinder, a 2-in. hardwood



Every garage has an old engine lying about. Why not turn it into a pneumatic punch?

block was then fastened with strap-irons bolted to the sides of the engine-bed, to hold it solid, and the center of this was bored to take the steel shaft or rod making the second bearing.

The rear end of the rod was threaded to take an ordinary drill-chuck, which later took the various punches.

Power for the punching was derived from the air-supply tank. To provide for the air connections, the hole over the intake valve was threaded to take a small length of gas-pipe and a reduction nipple, which was then provided with a small tire valve. The other valve was permanently sealed with solder.

A 2-in. block of wood was held in line with the drill-chuck by running two bolts through holes in the engine-bed and slipping the block in front of it.

Special punches were turned out for this chuck, running from 1/4 and 1/2 in. solid to 2 and 3 in. hollow for the various kinds of work to be done. The diagram shows some of the forms.

To operate this punch it was necessary only to insert the right punch in the chuck, apply the air hose to the tire valve, with the fiber in place (the core being out), and let the punch press out the hole desired. Removal of the air line from the inlet released the air and the punch was then easily pushed back for another. This was found very satisfactory in work where there was much cutting to do, all of the same sized holes.

To facilitate the returning of the punch to its original position after cutting out the hole in the material, a coil-spring was later slipped over the

## Tire Repairing Learn a Profession

Earn from \$300 to \$600 a month

Be a Tire Expert, we teach you free at our school or by mail. Thousands are getting in now. Locations are open everywhere.



**Badger Service Stations** We Put You In a Paying Business of Your Own Right from the Start

Small investment may mean a fortune to you in a short time. It assures you a large profit in a growing profession.

Motorists—Have your tires and tubes repaired by the new and famous Badger Method Tire Surgery—the only kind of work that will mean more Tire Miles to you. Badger Method Tire Repairing Service Stations everywhere.

Write today for complete catalog and full particulars on Badger Vulcanizers and How to open a Badger Service Station.

**Tire Repair Equipment Co.**  
230 Johnson St.  
Apleton Wisconsin



**Step Forgetting** The Key To Success. The secret of business and social success is the ability to remember. I can make your mind an infallible classified index from which you can instantly select thoughts, facts, figures, names, faces. Enables you to concentrate, develop self-control, overcome bashfulness, think on your feet, address an audience. Easy. Simple. The result of 20 years' experience developing memories of thousands.

**Write Today** for free booklet "How to Remember" and a Copy-righted Memory Test, also how to obtain a FREE book, "How to Speak in Public."

**Dickson School of Memory, 1929 Hearst Bldg., Chicago, Ill.**

**SIMPLE WIRELESS - ELEPHONES AND HOW TO MAKE THEM.** An elemental book on the principles, construction and use of an are system of wireless telephony. Price, 25 cents postpaid. Book Department, Popular Science Monthly, 225 West 39th Street, New York City.

**Be an Artist** Comics, cartoons, commercial, newspaper and magazine illustrating. Pastel crayon portraits and Fashions. Earn \$25 to \$200 a week. By our simple method your talent is quickly developed without interfering with present work. By Mail or Local Classes. The largest practical art school in the world. Write for full particulars and list of successful pupils, illustrated prospectus, etc. Endorsed by newspapers and magazines.

**ASSOCIATED ART STUDIOS, 48D, Flatiron Building, New York, N. Y.**

## STAMMERING

Complete and permanent cure effected at Bogue Institute. An institution with national patronage, for stammerers only. Founded 1901. Scientific treatment—combines training of brain with speech organs. Strongly endorsed by medical profession. 70 page book with full particulars, mailed free to all stammerers. Address

**BENJAMIN N. BOGUE, President**  
667 Bogue Building, Indianapolis, Ind.

## AVIATION FREE Information

Send us your name and address for full information regarding the Aviation and Airplane business. Find out about the many great opportunities now open and how we prepare you at home, during spare time, to qualify. Our new book "Opportunities in the Airplane Industry" also sent free if you answer at once.

**AMERICAN SCHOOL OF AVIATION**  
Dept. 169a 431 E. Dearborn St. CHICAGO

Send for a Complete Catalogue of **MASONIC BOOKS Jewelry and Goods**  
**REDDING & CO.**  
Publishers and Manufacturers  
200 Fifth Avenue Dept. S New York



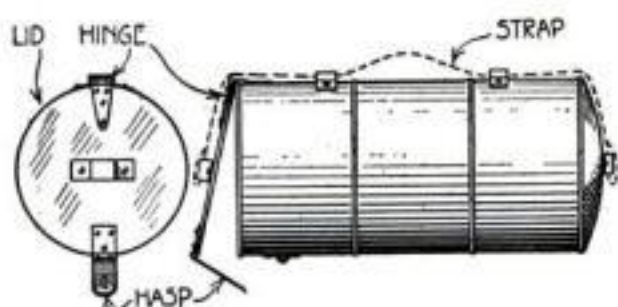
steel rod between the wood block and the piston.

With air pressure at 100 lbs. it was easy to secure a pressure of 600 and 800 lbs. on the punch, which, with the cutting edges in any respectable shape, was more than sufficient to cut through old tire casings and leather, and, in the case of the smaller solid punches, actually to cut through sheet iron and steel. For this smaller work, however, it was found advisable to provide the bed-block with a sheet of iron, with holes to correspond with the sizes of punches used, and to act as the stationary cutting edge.—DALE R. VAN HORN.

### A Metal Holder Used as a Tool-Box

A CERTAIN mechanic uses a tool-box of his own construction which has considerable merit.

The box is very much like a butterfly-hunter's specimen-box, but is built



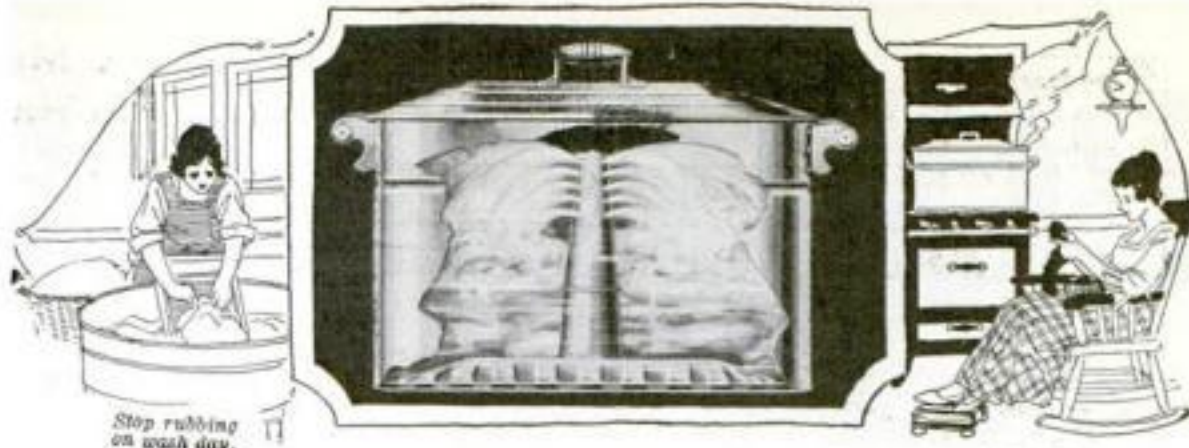
Though it looks like a specimen-box, it is really a mechanic's tool-carrying outfit

to stand rough usage. Heavy sheet metal is used in the construction. Four projecting ribs, two at the ends and two in the center, act as a reinforcement. The lid swings on a hinge, and is provided with a hasp for locking purposes. A leather strap, running through guides at each end, forms the handle.—J. M. KANE.

### Keep the Distributor Clean and Dry

EXCESSIVE oiling of the magneto can do nearly as much harm as insufficient lubrication. One thing it does is to cause the surplus oil to be thrown into the distributor, where it works much mischief. It gets between the brush and the contacts and either insulates them from each other entirely, causing missing, or it causes arching. Arching burns the oil and forms soot, which interferes with the good working of the machine, and it also produces heat, which disintegrates the carbon brush and causes it to crumble.

All magneto manufacturers make their distributors so that they may be removed easily and wiped clean with a dry, clean cloth. One type of machine, for instance, has its distributor held on by three little clips, retained by three thumb nuts. These may be loosened by hand, the clips turned aside and the distributor cover comes off in the hand. Other magnetos have three screws to



## Washing Machine for ONLY \$5.00

Who ever heard of a modern labor-saving device for such a price! You expect to pay around \$100.00—yet here is a machine GUARANTEED, not only to wash whiter and cleaner, but to do it easier and quicker than any complex device you have ever seen—yet only \$5.00.

An old proverb says: "The simplest things are the best"—and the Percolo is the simplest device ever! Steaming hot suds continually circulate up the funnel as in a percolator, out the holes, down thru the clothes, up, out and

down again and again—cleansing, whitening and sterilizing. Positively cannot injure any fabric that endures boiling—even the most delicate.

The Percolo converts your wash boiler into a most efficient laundry device. Requires no knowledge of machinery, no fussing. Just put in water, soap and clothes and forget it for the half hour or so, in which it does its job. No gears, cogs or parts to get out of order or to wear out. Nothing to oil, nothing to think of whatever.

**\$5** rids washing of drudgery forever

**PERCOLO**  
WASHER  
Steaming Water Washer

Saves money, labor, clothes, health, space

Give it the hardest tests you know of—greasy, grimy clothes to soiled but delicate curtains—you will find it the most thorough, the easiest, the most economical washer ever. At the end of 30 days' trial, we will refund your money (anywhere in U.S.A.) and pay charges both ways, if you are not 100% convinced—but you will be delighted, enthusiastic and amazed at such efficiency and such economy—for only \$5.00. Get free descriptive folder at once—better yet, order your Percolo today, prepaid, on our "Money back" 30-day trial offer.

**ERIE METAL PRODUCTS CO.**

Department 32

ERIE, PENNSYLVANIA

Do you want to SELL the Percolo? Write for terms

Quality First

# Boston Garter

*Velvet Grip*

**WORN THE WORLD OVER**

For more than forty years Boston Garter has been a friend to men the world over. It not only keeps the old friends but makes many, many new ones each season. Most men ask for Boston Garter as a matter of course—the two words go so well together.

George Frost Company, Makers, Boston



# BOYS



## Learn Drafting

Employers everywhere are looking for skilled draftsmen. They are offering good salaries to start with splendid chance for advancement.

Drafting offers exceptional opportunities to a young man because drafting itself not only commands good pay, but it is the first step toward success in Mechanical or Structural Engineering or Architecture. And drafting is just the kind of work a boy likes to do. There is an easy delightful way in which you can learn right at home in spare time. For 28 years the International Correspondence Schools have been giving boys just the training they need for success in Drafting and more than 200 other subjects. Thousands of boys have stepped into good positions through I. C. S. help, but never were opportunities so great as now.

Let the I. C. S. help you. Choose the work you like best in the coupon, then mark and mail it. This doesn't obligate you in the least and will bring you information that may start you on a successful career. This is your chance. Don't let it slip by. Mark and mail this coupon now.

### INTERNATIONAL CORRESPONDENCE SCHOOLS BOX 7680, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

- |                                                     |                                                  |
|-----------------------------------------------------|--------------------------------------------------|
| <input type="checkbox"/> ELECTRICAL ENGINEER        | <input type="checkbox"/> SALESMANSHIP            |
| <input type="checkbox"/> Electric Lighting and Hys. | <input type="checkbox"/> ADVERTISING             |
| <input type="checkbox"/> Electric Wiring            | <input type="checkbox"/> Window Trimmer          |
| <input type="checkbox"/> Telegraph Engineer         | <input type="checkbox"/> Show Card Writer        |
| <input type="checkbox"/> Telephone Work             | <input type="checkbox"/> Sign Painter            |
| <input type="checkbox"/> MECHANICAL ENGINEER        | <input type="checkbox"/> Railroad Trainman       |
| <input type="checkbox"/> Mechanical Draftman        | <input type="checkbox"/> ILLUSTRATING            |
| <input type="checkbox"/> Machine Shop Practices     | <input type="checkbox"/> Cartooning              |
| <input type="checkbox"/> Toolmaker                  | <input type="checkbox"/> BUSINESS MANAGEMENT     |
| <input type="checkbox"/> Gas Engine Operating       | <input type="checkbox"/> Private Secretary       |
| <input type="checkbox"/> CIVIL ENGINEER             | <input type="checkbox"/> BOOKKEEPER              |
| <input type="checkbox"/> Surveying and Mapping      | <input type="checkbox"/> Stenographer and Typist |
| <input type="checkbox"/> NINE FOREMAN or KNUT       | <input type="checkbox"/> Cert. Pub. Accountant   |
| <input type="checkbox"/> STATIONARY ENGINEER        | <input type="checkbox"/> TRAFFIC MANAGER         |
| <input type="checkbox"/> Marine Engineer            | <input type="checkbox"/> Railway Accountant      |
| <input type="checkbox"/> Ship Draftsman             | <input type="checkbox"/> Commercial Law          |
| <input type="checkbox"/> ARCHITECT                  | <input type="checkbox"/> GOOD ENGLISH            |
| <input type="checkbox"/> Contractor and Builder     | <input type="checkbox"/> Teacher                 |
| <input type="checkbox"/> Architectural Draftsman    | <input type="checkbox"/> Common School Subjects  |
| <input type="checkbox"/> Concrete Builder           | <input type="checkbox"/> CIVIL SERVICE           |
| <input type="checkbox"/> Structural Engineer        | <input type="checkbox"/> Railway Mail Clerk      |
| <input type="checkbox"/> PLUMBING AND HEATING       | <input type="checkbox"/> AUTOMOBILE OPERATING    |
| <input type="checkbox"/> Sheet Metal Worker         | <input type="checkbox"/> Auto Repairing          |
| <input type="checkbox"/> Textile Overseer or Supt.  | <input type="checkbox"/> Navigation              |
| <input type="checkbox"/> CHEMIST                    | <input type="checkbox"/> AGRICULTURE             |
| <input type="checkbox"/> Mathematics                | <input type="checkbox"/> Poultry Raising         |
|                                                     | <input type="checkbox"/> Spanish                 |
|                                                     | <input type="checkbox"/> French                  |
|                                                     | <input type="checkbox"/> Italian                 |

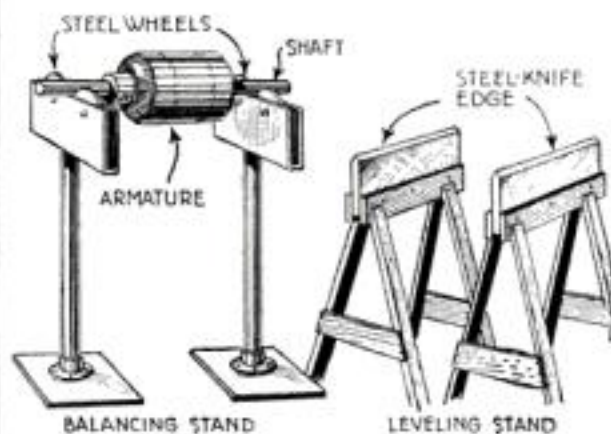
Name \_\_\_\_\_  
Present \_\_\_\_\_  
Occupation \_\_\_\_\_  
Street \_\_\_\_\_  
and No. \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_

Canadians may send this coupon to  
International Correspondence Schools, Montreal, Canada

retain the cover. Some have a central revolving brush and stationary contacts in the cover and others a revolving contact and individual stationary brushes in the cover. The brushes in either case are attached to small springs which may be slipped in or out.

## Balance Your Armatures and Eliminate Noise

If the armature of a motor is not balanced, it probably will cause noise when running at normal speed. In order to insure balance, the arma-



An unbalanced armature in a motor makes it noisy. A stand will enable it to balance

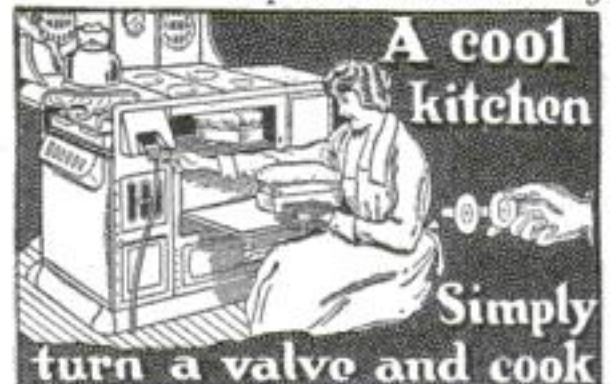
ture must be removed from the machine and placed on a balancing-stand or on level knife-edge bars to ascertain which is the heavy side. The accompanying illustration shows the procedure.

If the armature is balanced properly, it will show no uniformity in the power at which it stops after being rotated by hand; but if it is not in balance, it will invariably stop in the same position on the balancing rig, with the heavy side downward. A counterbalancing weight should then be hung on the light side, and thereupon, after slight filing, a very accurate balance will result. Before attempting to make a permanent correction ascertain by trial just how much weight should be added or removed.—PETER CLUTE.

## Utilizing the Hollow Handles of a Die-Stock

In threading pipe some form of lubricant is necessary to avoid ruining the dies, and it is the usual practice to carry along an oil-can, either in the tool-box or tied to the die-stocks.

Often when out on the job, one will find that the oil-can has been forgotten or perhaps lost. In this case the mechanic will have either to cut the threads dry, or damage the dies, or else to put up with the delay of obtaining the lubricant at a nearby store. Very often, indeed, this happens when the job is "ten miles from nowhere," and nothing in the way of grease or oil is obtainable. Under such circumstances it would be very convenient merely to unscrew one of the handles from the die-stock, and slip out a container filled with cup-grease or oil. This suggestion of utilizing the hollow



**A cool kitchen**  
Simply turn a valve and cook  
**30 Days Trial**  
The Oliver Oil-Gas Burner is an attachment that makes any cooking or heating stove a gas stove. No coal or wood. Cooks and bakes better than coal or wood in the same stove.  
**Makes Its Own Gas** from coal oil (kerosene) at one-fourth the cost of city gas. Everybody knows gas means cleaner, cheaper, quicker cooking, and a cooler kitchen. No fires to start, no ashes, no chopping, shovelling, poking and dragging of coal. Saves hours of work and loads of dirt. No smoke nor odor. You regulate heat with valves. Simple, safe, easily put in or taken out. Simply sets on grate. No damage to stove. Lasts a lifetime. Thousands of users. In use 10 years.  
**SAVES MONEY--FITS ANY STOVE**  
15 different models, one for every stove. Write for free literature—tells how two gallons kerosene equals more than ninety-seven pounds of coal.  
Oliver Oil-Gas Burner & Machine Co.,  
2007 Pine St., St. Louis, Mo.  
Western Shippers From San Francisco.  
**AGENTS**  
WANT TO SELL? Write for Agents.



## Your Chance to Make Big Profits in Vulcanizing

Here is your chance to get into a highly profitable business which will make you independent. High class vulcanizers are in demand everywhere. Many of our graduates make \$3,000 a year and over. We make the Anderson steam vulcanizer and Anderson retreader and teach you the famous Anderson Method of Vulcanizing. Our students make good because they can do superior work with the Anderson machine and method and do it at one-tenth the cost required by all other vulcanizers. Highly satisfied customers and large profits means a paying business. Not only are we able to convince you of this but we invite you to compare the Anderson make and method with others.

We have installed Anderson schools of vulcanizing in 30 states for teaching the Anderson method of vulcanizing. The course requires 5 to 10 days and costs \$20. If you buy an Anderson vulcanizer we return your \$20 and pay you \$2 per day expense money while learning.

Our reputation is valuable. We expect Anderson vulcanizers to do work which will outlast the rest of the tire. We expect Anderson students to succeed in a business way. Their success is our success. Therefore we do not sell an Anderson vulcanizer to anyone who has not received our course of instructions.

Don't miss this opportunity. Write today for full particulars and address of Anderson school nearest to you.  
**ANDERSON STEAM VULCANIZER CO.**  
13 Williams Bldg., Indianapolis, Ind., U. S. A.  
Print your name to avoid mistakes



## Send Your Name and We'll Send You a Lachnite

DON'T send a penny. Just send your name and say: "Send me a Lachnite mounted in a solid gold ring on 10 days free trial." We will send it prepaid right to your home. When it comes merely deposit \$4.75 with the performer and then wear the ring for 10 full days. If you, or if any of your friends can tell it from a diamond, send it back. But if you decide to buy it—send us \$2.50 a month until \$18.75 has been paid.  
**Write Today** Send your name now. Tell us which of the solid gold rings illustrated above you wish (ladies' or men's). Be sure to send finger size.  
Harold Lachman Co., 12 N. Michigan Av., Dept. A-120 Chicago

**Make Money—Be an AUCTIONEER**  
Missouri Auction School, the largest Auction School in the world. Four weeks course fits you to make big money. Col. A. W. Cies, Chillicothe, Mo., made \$1000 one day; Col. E. Walters, Skedee, Okla., made \$1746 one day. If you want \$50 to \$100 a day write today for free 67-page annual and read the stories of successes made by our graduates. Simply send name—let us tell you how to be a Successful and Prosperous Auctioneer. W. B. CARPENTER, Pres., Missouri Auction School, Dept. L 818 Walnut Street, Kansas City, Mo.

SUBMIT YOUR SONG-POEMS ON ANY SUBJECT FOR OUR ADVICE. WE REVISE POEMS, COMPOSE MUSIC OF ANY DESCRIPTION, SECURE COPYRIGHT AND EMPLOY ORIGINAL METHODS FOR FACILITATING FREE PUBLICATION OR OUTRIGHT SALE OF SONGS UNDER THIS SUCCESSFUL CONCERN-GUARANTEE OF SATISFACTION. THE TRUTH CONCERNING EVERY BRANCH OF THE GREAT WORK ACCOMPLISHED BY THE POPULAR SONG IN WINNING THE MARKET IS ONLY AN INDEX TO THE WIDER SCOPE AND GREATER OPPORTUNITIES AFFORDED BY PEACE. **SONG WRITERS' MANUAL & GUIDE SENT FREE** IT CONTAINS VALUABLE INSTRUCTIONS TO BEGINNERS AND TELLS THE GREAT WORK ACCOMPLISHED BY THE POPULAR SONG IN WINNING THE MARKET IS ONLY AN INDEX TO THE WIDER SCOPE AND GREATER OPPORTUNITIES AFFORDED BY PEACE. **KNICKERBOCKER STUDIOS, 204 GAFFNEY BLDG., N.Y. CITY**



handles of the stocks to carry an emergency ration of lubricant in a tubular container will be found very practical.

The outer ends of the handles can be plugged up with a piece of soft wood. This should be driven from the threaded end through the length of handle, and pressed tightly against the turned-in edges of the outer end, which will prevent the plug from slipping out, even if it shrinks. The hollow handles also provide a ready means of carrying such articles as spare hack-saw blades, candle, matches, etc., which, when wanted, are badly wanted.—J. A. WEAVER.

### Use a Simple Air-Blast for Your Power-Saw

THE illustration shows a device used by one carpenter in his shop to keep his work free from shavings and sawdust. A small motor drives a fan inserted in one end of a 4-in. galvanized iron tube, which tapers to a spout and is connected to a  $\frac{1}{2}$ -in. rubber air-line, the other end of which is secured at the point above the bench most effective for directing the air-stream on to the work.

A 2 by 6-in. piece was cut 3 ft. long, and the motor,  $\frac{1}{8}$  h. p., was mounted to one end. The tube, which contains the fan and acts as a cushion by con-

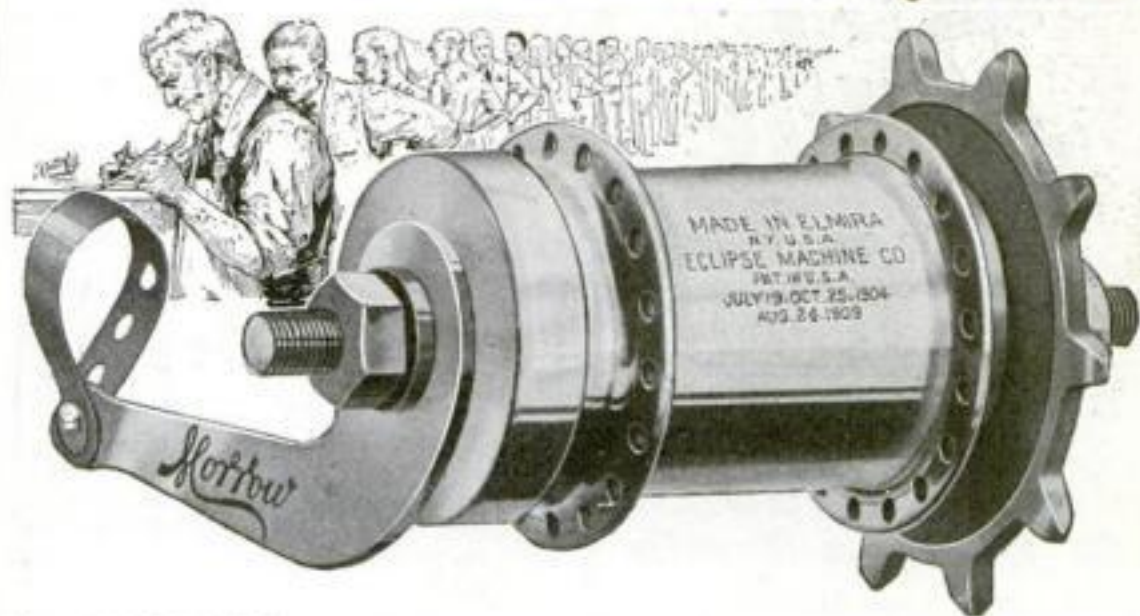


An air-blast on your power-saw will keep the sawdust and shavings away from your work and, incidentally, away from your eyes too

taining its length of air under slight pressure, was made of galvanized iron, 4 in. in diameter. Strap-irons hold the tube to the 2-in. support at a point where the 4-in. fan on the motor fitted within the tube without binding. The tube was 30 in. long.

To the other end of the tube, a small tin funnel was soldered, and the length of air-line was then slipped over the end and brought to the point of use. The outlet end of the air-line can be arranged to the best advantage. If it is to be used with a power-saw, it can be so wired that it will keep the pencil line free from dust. The air-pressure produced by the electric motor will be no more than  $\frac{1}{2}$  lb., but it will be sufficient, and the expense is practically nothing.—DALE VAN HORN.

# 95 Inspections Protect you



Every MORROW Coaster Brake must meet the requirements of 95 separate inspections and tests before it leaves the factory as a

## Morrow STURDY, SURE COASTER BRAKE

When the brake is completed, as a final test for its braking power, heavy weights are attached to the hub which is then revolved at a tremendous speed.

Suddenly, while the hub is revolving at this high speed, the brake is applied. A MORROW which meets all requirements—and it is seldom that one doesn't—will bring those speeding weights to a quick, sure halt.

To do this a MORROW must be as strong and sturdy as it is possible to build it. Then, too, it has the advantage of embodying the correct principle of braking—even distribution of braking power over practically the entire inner surface of the hub.

### 7 Reasons for the Morrow

- 1 Braking surface 6 3/10 sq. in.—much larger than other brakes.
- 2 'Drum' expansion forced equally by two wedges at each end, insuring even braking distribution over entire inner hub surface.
- 3 Bronze brakeshoes being softer than hard steel inner surface, grip smoothly, firmly, surely.
- 4 For forward pedaling, the Morrow responds instantly and positively.
- 5 More ball-bearings than other brakes, so coasts more easily.
- 6 The Morrow is strong and sturdy; it will stand hard wear.
- 7 Ninety-five inspections, followed by a final test, guaranteeing perfect service.

*"Ride a Bicycle"*

ECLIPSE MACHINE COMPANY  
ELMIRA, NEW YORK

*Demand the MORROW on the next Bicycle you Buy*

### Dollars in Hares

We pay \$7.00 to \$18.50 and up a pair and express charges. **Big Profits.** We furnish guaranteed high grade stock and buy all you raise. Use backyard, barn, cellar, attic. Contract and Illustrated Catalog Free.

STANDARD FOOD AND FUR ASS'N  
407C Broadway New York



### You Can Save \$50.00

By recovering your old auto top frame yourself. We make these recoveries to fit all makes and models of cars. Any person that can drive a car can put it on. We furnish instructions. Roof and quarters sewed together with rear curtain, fasteners, welts and tanks. All complete. Give us the name, year and model number of your car and we will send you our catalogue with samples and quote you exact price.

**\$8.46 and up**  
Parcels Post Paid

LIBERTY TOP & TIRE CO., Dept. E2, Cincinnati 4, O.



**TAKING OUT THE KINKS AND MAKING THE FAMILY GOOD NATURED WITH A**

## WHITING-ADAMS HAIR BRUSH

**A family requisite. Beautiful designs, handsomely finished. Best quality pure Russian bristles. Once used always preferred.**

Send for Illustrated Literature

**JOHN L. WHITING-J. J. ADAMS CO., Boston, U. S. A.**  
Brush Manufacturers for Over 109 Years and the Largest in the World



## An Improvement on the Artist's Pantograph

By James M. Kane

THE inconvenient construction of an ordinary wooden pantograph led the writer to remodel it as displayed in the illustrations.

The marking point and stylus were screwed to the under side of arms *B* and *D*. Being hard to shift for reducing a drawing, they were removed and fitted upon pencil-holding devices

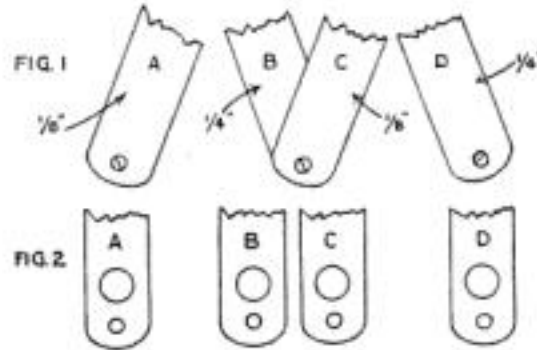


Fig. 1 shows the ends of the arms as they were originally; Fig. 2 shows the new series of holes in them

which made the pencil and stylus quickly interchangeable and adjustable for height as well.

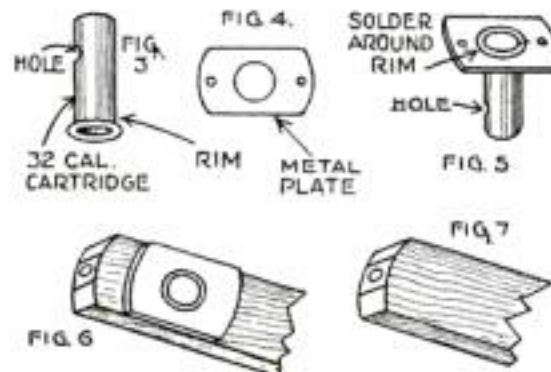
Two 32-caliber cartridge shells (long), two inches of the brass frame of an old alarm-clock works, an old gas-globe holder, four small screws, and two 1/2 in. pieces of tubing to slip over the cartridges were all the materials required.

Fig. 1 shows the ends of the arms as they were originally.

Fig. 2 shows the new series of holes in line. The small hole in *A* is a shifting of the hole upward, so that the fastening screw will line up centrally with the holes in *BCD*. These holes were carefully bored and trimmed so that the pencil-holding devices would fit correctly.

Fig. 3 shows how the end of each shell was bored out, leaving the rim intact; it also shows the hole in the side for the entrance of the point of the tightening screw.

Fig. 4 shows the metal plate, made from the section of the alarm-clock



Figs. 3 to 6 show how the holder was made and fitted into the hole in the pantograph's arms

frame, soldered to each shell. This plate is bored for the insertion of screws.

Fig. 5 shows the plate soldered to the cartridge.

Fig. 6 illustrates the holder fitted into the hole in the pantograph arm and screwed fast.

Arms *B* and *D* are each fitted with one of these holders. The holder in arm *B* also acts as a pivot for arm *C*. In this it performs the function of the screw that originally held arms *B* and *D*.

To hold the pencil and stylus securely, as well as to permit adjustment for height, short metal collars fitted with tightening screws were slipped over each holder.

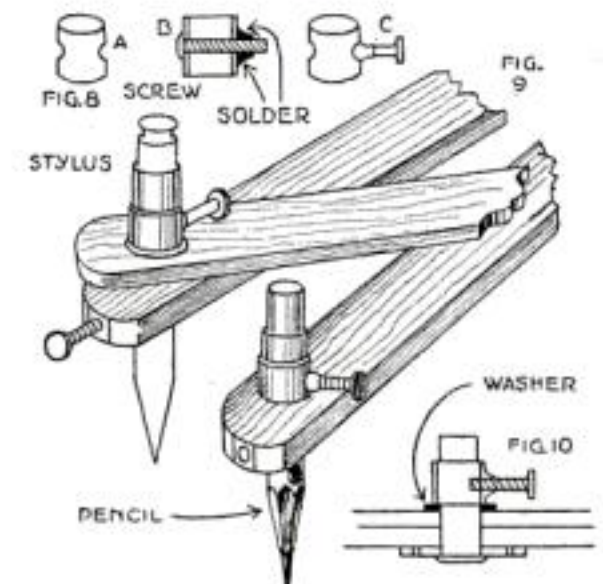
The old globe-holder furnished the screws and nuts, while the two 1/2 in. sections of tubing provided the collars.

The only difficult part of the whole operation is soldering the small nuts on the collars. This is the way to do it.

First cut off the section of the globe-holder that holds the nuts and screws and file the nuts bright. Then bore a hole, in line, through each side of the collar (*A*, Fig. 8). Now run the screw through the collar and attach the nut securely to it (*B*, Fig. 8). After soldering the nut, remove the screw and replace it as in *C*, Fig. 8.

Fig. 9 shows in perspective the arms fitted with the improvement.

Fig. 10 is a cross-section of arms and



Figs. 8 to 10 show how the pencil and stylus may be interchanged

holder. It also shows a thin washer that may be placed between the bottom of the collar and the upper surface of arm *C*.

Into the ends of arms *B* and *D* small nuts taken from globe-holders may be glued to serve as sockets for the reception of an extension handle.

## Keep Your Eye on the Automobile Generator

THE brushes are a part of the generator that demand the most care. They should be examined to see that they are in perfect contact with the commutator, and that they do not stick in the brush-holders. One of the most usual causes of imperfect contact between the brush and the commutator is insufficient spring tension.

The commutator must be kept clean, as any dust or grease on the segments will collect carbon dust and produce short circuits.



# Rahe

will train you to be successful in the

## Auto, Truck Tractor and Aviation Business

in 6 to 8 Weeks

Earn \$150

to \$400 a Month

I have Four Big Buildings, Twice More Floor Space and Twice More Equipment used in daily training practice than in any other auto school in America.

My school is recognized by manufacturers as the greatest and best automotive training school. I have letters from such factories as Packard, Hudson, Chalmers, Maxwell, King, Hupmobile and others endorsing my school. All the big Auto Companies need Rahe trained men. I trained thousands of soldiers as motor mechanics for U. S. Government in 60 days' time.

# Rahe

## Auto & Tractor School

World's Oldest and Greatest

30,000 Rahe trained men now numbered among the biggest and most successful men in the Automotive industry. They owe their higher skill and better ability to the Rahe Practical Method. Vast equipment—Autos, Trucks, Tractors of all kinds; all latest motors, 4's, 6's, 12's, block mounted. Electrical Starting and Ignition Systems of all types. Biggest Machine shop. Greatest Live Motor Department in the country. Plenty of room for individual training under Master Mechanic Instructors.

Any man 16 years and older can fit himself in my school. No previous experience needed. No tools or extras to buy. You earn big money from the day you graduate. Always more calls for Rahe Trained Men than we can supply.

**Send for Proof:** Use the Coupon below and send at once for Free 68-page Catalog and proof of graduates' success.

**HENRY J. RAHE,**  
Dept. 2887  
Kansas City, Mo.

Mail the coupon for 68 page book showing opportunity and why Rahe Method is best—sent

**FREE**

Name.....

Address.....

Age..... Occupation.....



## An Easy Way to Put Wire-Cloth on Screen Doors

THE screen door, which contributes so much to the comfort of the human race, has one drawback, the rusting of the wire cloth. New material must be put on to replace the old, and this is a very disagreeable task. To do the job in double-quick time the writer has devised the simple plan illustrated, which proves to be much more efficient than the usual method of stretching wire-cloth on screen doors.

The old way of doing this work was to tack one side down first and then to pull the opposite one as tightly as



Here is the way to make a one-man job of putting wire-cloth on screen doors

possible with one hand; the other hand was used to stick a tack in the wood and hammer it down. Of course, if the workman has another member of the family do the tacking while he tightens the cloth, a much neater job can be done.

The new method requires the work of only one person, and it enables that one person to do a neater job than two could turn out under the old plan.

The illustration shows clearly the wedges and tightening pieces which are needed. They consist simply of a piece of wood the length of the door, with flat pieces nailed or screwed at right angles to the tightening-bar.

Lay the door flat on the floor and tack one edge of the wire cloth to the top of it. Then tack the other end of the cloth to the second section, adjusting the wedges in such a manner that they will have some space to drive in and stretch the cloth. Drive in the wedges until the cloth lies smooth, then tack it down, cutting off any surplus cloth with a pair of scissors. As the door is put over the right-angled pieces, the weight of it prevents the wedges from flying out when tension is exerted on the cloth. Do not have too much tension put on the cloth when it is fastened down, for when it begins to rust in one part, it will break under expansion and contraction. Since most people take the doors off when cold weather approaches, it will be found that in time the hinge-screw holes will become so worn that the screws will

W.L. DOUGLAS FREQUENTLY WORKED 18 TO 20 HOURS A DAY—RETURNING TO HIS FACTORY MANY A NIGHT TO LAY OUT THE NEXT DAY'S WORK AFTER SPENDING THE DAY IN BOSTON BUYING LEATHER AND SELLING SHOES.

AT THE START, W.L. DOUGLAS WAS BUYER, CUTTER, SALESMAN AND FREQUENTLY HIS OWN EXPRESSMAN AS WELL. OLD BROCKTON RESIDENTS TELL OF OFTEN SEEING HIM COMING FROM BOSTON CARRYING A ROLL OF LEATHER UNDER HIS ARM.

BEGAN MANUFACTURING JULY 6 1878

1852

W.L. DOUGLAS PEGGING SHOES AT SEVEN YEARS OF AGE

W.L. DOUGLAS \$9.00 SHOE

FOR MEN AND WOMEN

# W. L. DOUGLAS

"THE SHOE THAT HOLDS ITS SHAPE"

\$7.00 \$8.00 \$9.00 & \$10.00 SHOES

BOYS' SHOES \$4.50 \$5.00 \$5.50

W. L. Douglas shoes are sold in 107 of our own stores direct from factory to the wearer. All middlemen's profits are eliminated. W. L. Douglas \$9.00 and \$10.00 shoes are absolutely the best shoe values for the money in this country. W. L. Douglas name and the retail price stamped on the bottom guarantees the best shoes in style, comfort and service that can be produced for the price.

Stamping the price on every pair of shoes as a protection against high prices and unreasonable profits is only one example of the constant endeavor of W. L. Douglas to protect his customers. W. L. Douglas name on shoes is his pledge that they are the best in materials, workmanship and style possible to produce at the price. Into every pair go the results of sixty-seven years experience in making shoes, dating back to the time when W. L. Douglas was a lad of seven, pegging shoes.

The quality of W. L. Douglas product is guaranteed by more than 40 years experience in making fine shoes. The smart styles are the leaders in the fashion centers of America. They are made in a well-equipped factory at Brockton, Mass., by the highest paid, skilled shoemakers, under the direction and supervision of experienced men, all working with an honest determination to make the best shoes for the price that money can buy. The retail prices are the same everywhere. They cost no more in San Francisco than they do in New York.

W. L. Douglas shoes are for sale by over 9000 shoe dealers besides our own stores. If your local dealer cannot supply you, take no other make. Order direct from the factory. Send for booklet telling how to order shoes by mail, postage free.

**CAUTION.**—Insist upon having W. L. Douglas shoes. The name and price is plainly stamped on the sole. If it has been changed or mutilated, BEWARE OF FRAUD.

President  
W. L. DOUGLAS SHOE CO.  
134 Spark Street,  
BROCKTON, MASS.

## "GOLD MEDAL"

### Folding Furniture

is known the world over for its neat appearance, comfort, convenience and strength. It's the ideal Folding Furniture.

"Gold Medal"—"The Cot of Many Uses"—for emergencies, porch, camp and summer home, there's nothing better. Light, compact when folded, quickly set up.

Sold by Furniture, Hardware, Sporting Goods Dealers—and Tent-Makers—everywhere.

Write for complete catalog.

Gold Medal Camp Furniture Mfg. Co.  
1724 Packard Ave., Racine, Wis.

A comfortable porch or camp chair. Weighs only 14½ lbs., and folds to 4' x 21" x 27".

For washing and dressing the baby—a convenient, strong dressing table. Has pockets for powder, brushes, soap, etc. Weighs only 8½ lbs., folds to 3'2" x 2' x 4'.

## GOLD MEDAL

Furniture For Home and Camp

## PLAY BY EAR

MUSIC AND NOTES NOT NECESSARY

### BE A REAL PIANIST

# 20 LESSONS by MAIL

**Be a Jazz Music Master**

Yes, you can, even if you have never touched a piano. The Niagara School of Music has perfected a method of instruction which will enable you to play all the popular songs hits perfectly by ear. All you need to know is how to hum a tune. Our method—only 20 lessons, which you can master in a little while—will enable you to transform the tune which is running through your head into actual JAZZY music on the piano. All by ear.

**It is Easy to Learn**

Many masters of Jazz and Ragtime music don't know a note. Be a Music Master yourself. It is easy—the lessons interesting and simple—no tedious dine-dine daily practice, with the do, re, mi, until you think you will go crazy—not at all—just 20 brief, entertaining lessons and you have musical ability at which your friends will marvel. You simply play by ear.

**Hum the Tune, Play it by Ear**

Hear a new popular song hit, hum the tune, play it yourself. All by ear. Just think how many dull hours this easily acquired ability will make happy, how many friends you will make happy, how popular you will be when you JAZZ the newest song success of Broadway after hearing it. All done by ear.

Be a "Jazz Music Master" and enjoy life. Send for our free booklet, "The Niagara Method" today. It is brimful of interesting and live matter.

NIAGARA SCHOOL OF MUSIC, Niagara Falls, N.Y.  
Dept. 27 —MAIL THIS TODAY—

Without obligation to me, please mail to address below, your Name, Street, City, State.





**Hoist It With a Yale Chain Block**  
ECONOMY-SPEED-SAFETY

Hook a Yale Chain Block to any load. Pull one side of the hand chain and the load is easily and swiftly lifted—and held safely suspended after you let go of the hand chain. It will not lower until you pull the other side of the hand chain.

Wherever heavy boxes, kegs, iron, bales, machinery, logs, pipe or paper must be lifted—occasionally or constantly—there is a Yale Chain Block that will do the work safer, quicker and better.

Seventeen sizes -  $\frac{1}{4}$  to 40 tons.  
"Put Your Hoisting and Conveying Problems Up To Us."

Write for your copy of the "Yale Hoists" Catalog, today

Yale Chain Blocks are made by the makers of Yale locks. Like them, they bear the trade-mark "Yale" as evidence of their superiority and origin. See "Yale" on Builders' Locks and Hardware, Padlocks, Night Latches, Door Closers, Cabinet Locks, Bank Locks, Chain Blocks, and Electric Hoists.

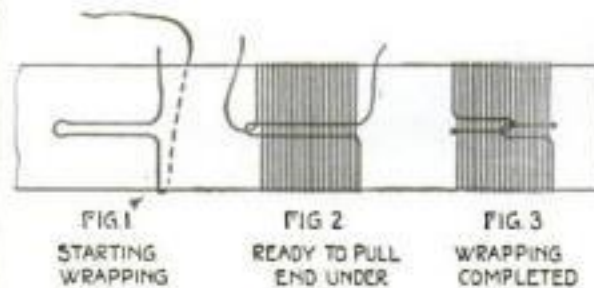
**The Yale & Towne Mfg. Company.**  
Makers of the Yale Locks.  
Works and General Offices: Stamford, Conn.  
New York Office: 9 East 40th Street.  
Chicago Office: 77 East Lake Street.  
Canadian Yale & Towne Ltd., St. Catharines, Ont.

fail to hold the hinges tight, thus allowing the door to sag. The remedy in this case is to use thicker or longer screws, or to stop the holes with hardwood plugs and fastening-hinges in the hardwood. Either plan will make a satisfactory job.—W. S. STANDIFORD.

## How to Tie the Invisible Armature Knot

AFTER the armature of a motor has been rewound, and the leads have been soldered to the commutator, a wrapping consisting of a single layer of heavy twine is wound around the leads to hold them firmly in place. The action of the centrifugal force would otherwise tend to tear them loose when the motor's armature is rotating at high speed. The wrapping serves also as a protective covering for the leads. Incidentally it gives the winding a finished appearance when it is neatly applied. The appearance and ability to "stay put" depend upon the knot used to tie the ends of the twine. The so-called invisible knot has the qualities desirable for this purpose and is one of the little tricks of the trade used by all experienced armature-winders.

The method of tying the knot is depicted in the accompanying illustration. For the sake of clearness, the object upon which the wrapping is applied is shown merely as a piece of round rod, instead of the armature leads. The start is shown in Fig. 1. One end of the twine is doubled and laid along the length of the rod for a distance a little greater than the width



Illustrating exactly how the ends of the invisible armature knot are cut off

of the intended wrapping, in order to form the loop. Then, while the loop is held in place, the ball of twine is given several turns about the rod, a moderate tension being kept on it so that the first few turns will grip the portion of the loop over which they cross sufficiently tight to prevent its slipping. The wrapping is then continued until it covers the part intended. The twine is now cut, leaving a liberal end which is threaded through the loop and held taut with one hand, while the other end is pulled until the junction of the two loops thus formed is in about the center of the wrapping. Both the extending ends may now be cut off close to the end turns. Of course, an armature wrapping is given the usual several heavy coats of shellac which further improve its strength and appearance.—JOHN A. WEAVER.



**I Earned \$2200 IN FOUR MONTHS**

**THIS is Richard A. Oldham.** He earned \$2200.00 in four months with a Haywood Tire Repairing outfit. For 20 years he was telegraph operator on the Illinois Central Railway. He is now 58 years old. He answered my advertisement—quit his job—bought a plant and opened a business. He just wrote me "I have made more in eight months than 2½ years as operator." There are now 500 stations where tire repairing is neglected.

**I Must Have 500 Men To Fill These Positions**

I have a Big interesting Book to send you. It tells all about tires—gives inside figures and profit. Send for it! What Oldham and others are doing You can do. \$2500.00 to \$4,000.00 per year is conservative. Like Mr. Oldham—One machine will start you. Then open a shop. You can see business all around you. Put out a Haywood Sign and business will come to you. Now get started. Send for the Big Book and start making money.

**M. HAYWOOD, Pres.**  
**Haywood Tire & Equipment Co.**  
1275 Capitol Ave. Indianapolis, Ind.

## Shoot Without Noise

Learn to be a good shot at home. No disturbance even in the house when your rifle is equipped with a

## MAXIM SILENCER

Price, .22 cal., \$5.00.  
Send 6c in stamps for catalogue and booklet of numerous stories of noiseless shooting.

The Maxim Silencer Co.  
91 Homestead Ave., Hartford, Conn.

## I Have Been Successful and My Book



## "Motion Picture Electricity"

will teach you in simple form how to install, operate and maintain electrical equipment for moving picture theatres and scenic effects. The book is handsomely bound with gilt edge containing 300 pages and 128 specially made illustrations, most of which are not found in any other text book. The price is only \$3.00 delivery prepaid.

I have been in the motion picture theatre equipment business for 12 years and my experience is yours through my book, "Motion Picture Electricity."

### ORDER COUPON

J. H. HALLBERG,  
1604 Broadway, New York City.

Dear Sir:—Send postpaid to the address below your 300 page book entitled "Motion Picture Electricity," price \$3.00.

I enclose \$.....

Name .....

Address .....



**Catch Big Fish**

Enjoy the thrill and excitement which bait-casting angling gives, by casting for 'em with the **South Bend Reel** which entirely eliminates back-lashes, snarls and tangles. Our book "The Days of Real Sport" tells tried and proven casting methods. Shows complete **South Bend Tackle** line.

A postal brings it FREE.  
**SOUTH BEND BAIT CO.**  
14590 High St., South Bend, Ind.



**30 DAYS FREE TRIAL**

and freight prepaid on any "RANGER" bicycle. Write at once for our big catalogue and special offers. Select from 44 styles, colors and sizes in the "RANGER" line. EASY PAYMENTS if desired, at a small advance over our Special Factory-to-Rider cash prices. You cannot afford to buy without getting our latest propositions and Factory-to-Rider prices. Boys, be a "Rider Agent" and make big money taking orders for bicycles and supplies. Liberal terms on a sample to introduce the new "RANGER". Tires, equipment, sundries and everything in the bicycle line at half usual prices. Write today.

**MEAD CYCLE COMPANY**  
Dept. D100 Chicago



## An Indirect-Lighting System for Your Own Home

IN southern California electricity is very cheap, and, consequently, it is widely used. A great many people, however, are contented with the glaring, unshaded light hanging in the middle of the room. This is very hard on the eyes and, moreover, does not light the room properly.

The illustration shows one corner of a room in which a homemade, indirect-



Reflectors placed over your glaring electric lights will soothe your tired eyes and rest your nerves

lighting system is installed. The reflectors are ordinary washbasins costing 15 cents each. They were given several coats of white paint and finished with an enamel that dried with a gloss. Four lights were placed in the room, spaced symmetrically, so that an even illumination was secured. The reflectors were hung with ordinary iron chain purchased at a hardware store. The brass canopy to which the chains are attached was bought from an electrical supply house. The chains and basins were so arranged that the basins can be detached in a few seconds and dusted out, since it is very necessary to keep the reflectors and bulbs free from dust and dirt if one is to get good light. The ceiling should be painted white to get the best results.—N. O. MOORE.

## Don't Throw Away Your Old Window-Shades

MANY house-furnishing store salesmen will tell you that Holland shades are unobtainable. That is not quite true, but it is a fact that linen shades are scarce and very high in price.

Any housewife should hesitate to throw away old linen shades even when they have become wrinkled, faded, and thin. The trouble with the old shades is that the filler has dropped out of the linen. This can be remedied

# Every Electrical Appliance Instantly Useful

Provide at least one connection in every room from which you can have light and heat, or power at the same time. The



is the electrical device that screws into any electric light socket and gives you two services where there was only one before. Millions are in use, doubling the convenience of electricity in hundreds of thousands of homes.

*"Every Wired Home Needs Three or More"*

AT YOUR DEALER'S

**3 for \$3.50**  
OR \$1.25 EACH

Made only by  
**BENJAMIN ELECTRIC MFG. CO.**  
Chicago New York San Francisco

You can still further increase the convenience of your appliances if you have the cord equipped with a **Benjamin 903 Swivel Attachment Plug**. It screws into the socket without twisting the cord.

The **Benjamin No. 2452 Shade Holder** enables you to use any shade with your Two-Way Plug.



The Quality Plug



### "Lighting Fixtures"

Ready to hang.  
Direct from manufacturers.  
Completely wired including glass-ware.  
Send for new No. 18 catalogue.  
**ERIE FIXTURE SUPPLY CO.**  
Desk A, Erie, Pa.

### "DON'T SHOUT"

"I hear you. I can hear now as well as anybody. 'How?' With THE MORLEY PHONE. I've a pair in my ears now, but they are invisible. I would not know I had them in, myself, only that I hear all right."

The Morley Phone for the **DEAF**

is to the ears what glasses are to the eyes. Invisible, comfortable, weightless and harmless.

Anyone can adjust it. Over one hundred thousand sold. Write for booklet and testimonials.  
**THE MORLEY CO., Dept. 797, 26 South 15th Street, Philadelphia**

### World's Best Roofing at Factory Prices

**"Reo" Cluster Metal Shingles, V-Crimp, Corrugated, Standing Seam, Painted or Galvanized Roofings, Siding, Wallboard, Paints, etc., direct to you at Rock-Bottom Factory Prices. Positively greatest offer ever made.**

**Edwards "Reo" Metal Shingles**  
cost less; outlast three ordinary roofs. No painting or repairs. Guaranteed rot, fire, rust, lightning proof.

**Free Roofing Book**  
Get our wonderfully low prices and free samples. We sell direct to you and save you all in-between dealer's profits. Ask for Book No. 698

**LOW PRICED GARAGES**  
Lowest prices on Ready-Made Fire-Proof Steel Garages. Set up any place. Send postal for Garage Book, showing styles.  
**THE EDWARDS MFG. CO., 648-698 Pike St., Cincinnati, O.**

**FREE**  
Samples &  
Roofing Book



## AGENTS 500% PROFIT

### Gold and Silver Sign Letters

For store fronts, office windows and glass signs of all kinds. No experience necessary. Anyone can put them on and make money right from the start.

**\$40.00 to \$100.00 a Week!**

You can sell to nearby trade or travel all over the country. There is a big demand for window lettering in every town. Send for free samples and particulars.

**Liberal Offer to General Agents.**  
**METALLIC LETTER CO.**  
433A North Clark Street, CHICAGO, ILL



## Through Yellowstone with an Auto-Wheel

It makes a dandy hike. You can load all your baggage on the

Auto-Wheel Coaster  
or the

Auto-Wheel Convertible Roadster

and see all the sights. See Old Faithful Geyser shooting a column of steaming hot water 135 feet in the air, or a thousand other wonderful things.

The Auto-Wheel Coaster or Convertible Roadster is a mighty dependable helper on such trips. It carries all the baggage—even a 1,000 pound load is carried without effort. Roller-bearings make the Auto-Wheel pull easily over most any old road.

You may not be able to hike through Yellowstone but the words "round your home will make a fine hiking ground. Try it some day."

Our New Magazine for Boys

tells how fellows are making hiking trips. We'll be glad to send it to you. We'll also send you a Free Felt Pen and tell you about the Auto-Wheel Coaster Club which you can organize, if you write telling us the names of three coaster dealers, mentioning which handles the wagons with the name "Auto-Wheel" on the sides.

The Buffalo Sled Co.,

157 Schenck Street  
N. TONAWANDA, N. Y.  
In Canada: Preston, Ont.



## "Old Town Canoes"

You can lazy-paddle an "Old Town" all day long. "Old Towns" are light, buoyant Canoes that answer the slightest pressure of the blade.

They are strong, sturdy canoes built for years of service. The "Sponson Model" is safer than a row boat. Write for catalog. 3000 canoes in stock.

OLD TOWN CANOE CO.

1996 Main St.  
Old Town, Maine, U. S. A.



**REPAIRER WILL SAVE**  
**BIG MONEY SAVINGS FOR YOU**  
\$40  
Used and rebuilt motorcycles, single and twins, \$25 to \$100. Used bicycles, \$5.00; tandems, \$10. All machines guaranteed in good working order. New bicycles and motorcycles at factory prices. You save dealers' profits. Motorcycles and automobiles tires too, \$2.00. Complete line of parts and supplies.  
Send for catalog  
Deninger Cycle Co., Rochester, N.Y.  
**YOU 25 TO 50 DOLLARS**

### WANTED

#### Representatives in Every Factory

Popular Science Monthly keeps abreast of the times in new inventions and discoveries. Many of the new ideas come from the skilled workmen in the factory.  
We want representatives in every factory in the country. It will mean money to you if you make good.  
POPULAR SCIENCE MONTHLY, 225 West 39th Street, New York

at small cost and with little trouble.

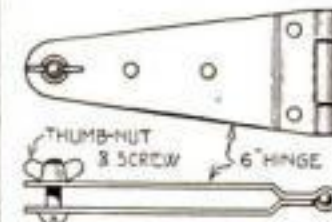
Buy a can of ordinary flat wall-paint and reduce it by adding twenty-five per cent of turpentine. Remove the curtains from the rollers, tack them down smoothly on a bare floor or table, and apply one coat of the paint. To eliminate brush marks go over it immediately with a dry stiff-bristled brush.

The shades may be painted to harmonize with the room. It is possible, also, to have the outside of the shade one color and the inside another.

By this treatment window-shades may be kept looking bright and clean, and at the same time save the expense of buying new ones.

## A Large Hinge Serves as a Clamp for Tire Repair

THE illustration shows how a large hinge can be made into a clamp convenient for use on the road, especially when repairing tires. The



A large hinge can be made into a clamp to aid your tire repairing

hinge is bent to leave about  $\frac{1}{8}$  in. clearance between the two halves. The holes on the extreme ends are enlarged slightly to take a small bolt, provided

with a thumb-nut, as shown.

This clamp will be found useful in mending tires, since the clamp can be applied after the patch has been put on, and a better job is thus insured.

The tool can also be used as a vulcanizer. It is clamped over the patch to be vulcanized on; a small pill-box cover half-filled with gasoline is set over it, and the gasoline is allowed to burn away. If the process is carried on in a sheltered spot, free from wind, the vulcanizing job will be finished in very good shape.—DALE R. VAN HORN.

## A Gravity Electric Bell Made of Odds and Ends

AT very slight expense an electric bell with no springs or delicate adjustments to become disarranged, can be constructed of odds and ends found about the work bench.

Mount an old bell or gong at the bottom of a wooden base as shown in the illustration. Then cut out a metal support, as shown in detail, and fasten it to the top edge of the base so that the large hole will project about 1 in. above the surface.

The magnet is made of a soft iron bolt wound with several layers of fine magnet-wire. These layers are held in place by two wooden buttons slipped over the shank of the bolt, the flat sides facing each other. Then the magnet is bolted to the support and the nut is drawn up so that the windings, buttons and bolt-heads are held close together.

## Attach this Motor to Your Boat

New pleasures are open to the man who attaches a Lockwood-Ash Row Boat Engine to his row boat.

It saves those long, hot, back-breaking pulls to the fishing or picnic grounds or the camp.

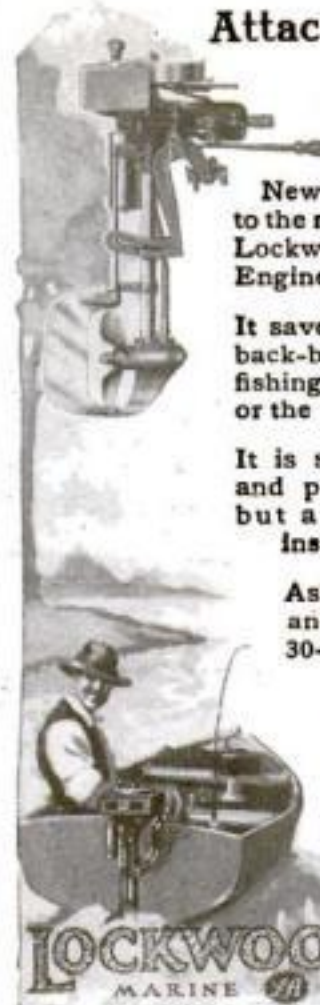
It is simple, economical and practical and takes but a few minutes to install.

Ask for our booklet and learn about the 30-day trial plan.

Lockwood-Ash Motor Company

2013 Jackson Street  
Jackson, Mich.

(69)



**\$1 Week**  
**Magnificent Bicycle Offer**  
Have fun and healthful exercise with a bicycle! Own the Black Beauty, the finest bike in the world! No waiting. Just send for Catalog, select your model, and we'll ship at once. Pay a small deposit, then \$1 a week (or \$5 a month). Direct to you at FACTORY PRICE.  
**\$1 A WEEK**  
pays for the  
**Black Beauty**  
18 Exclusive Features The wonderful Black Beauty equipment includes \$10 Firestone Blue Non-Skid Tires; New Departure Coaster Brake; motorcycle saddle, pedals and handlebars; chrome steel ball bearings, etc.  
**FREE.** Repair Kit, Tool Case and Stand  
Five yr. guarantee, and six mos. insurance on the wheel. The Black Beauty has sporty lines, marvelous steel construction, dazzling finish. Write today for Catalog.  
**Sundries** Get our factory prices. Lowest in the country. Tires, lamps, horns, rims, etc. Send for Free Sundries Catalog.  
Haverford Cycle Co.  
Dept. 386 Philadelphia  
pays for the  
**Black Beauty**  
**FREE Catalog**  
in colors

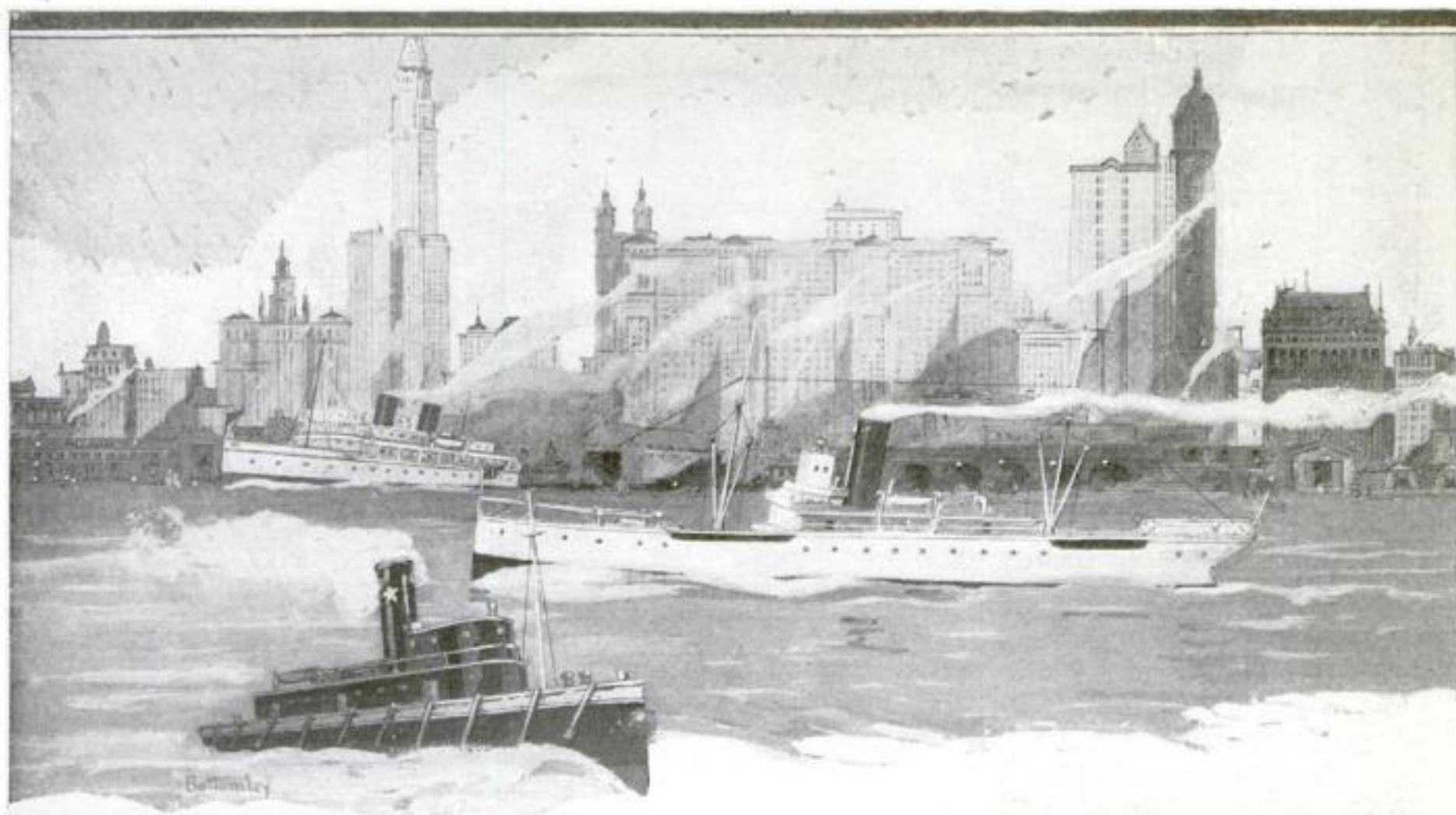
**Print Your Own**  
cards, circulars, labels, tags, menus, book, paper. Press R. Larger \$25. Job Press \$10.00. CUTS EXPENSE IN HALF. SMALL OUTLAY. Pays for itself in short time. Will last for years. Easy to use, printed rules sent. Print for others. BIG PROFIT. Write factory TODAY for press catalog. TYPE, cards, paper, envelopes. THE PRESS CO., D-33, Meriden, Conn.  
**EXCELSIOR**

**CLASS PINS-RINGS**  
DIRECT FROM FACTORY TO YOU  
OUR NEW CATALOG WITH 600 OF THE LATEST UP-TO-DATE DESIGNS FREE.  
C. K. GROUSE CO.  
12 Bruce Ave., North Attleboro, Mass.

## \$10.00 FOR YOU.

How would you like to make \$10.00 a week during your spare time? Others are doing it by representing POPULAR SCIENCE MONTHLY. Why not you?  
POPULAR SCIENCE MONTHLY, 225 West 39th Street, N.Y.C.





# Boats just like the real ones— they run by power in water

The wonderful harbor of New York! The famous Woolworth building, 792 feet high, in the background, and in the foreground enormous wharves and docks and thousands of ships—busy tugs, big ferry boats, giant ocean liners and Uncle Sam's warships.

Wouldn't you like to have a whole fleet like that? Well, you can! Ives fine steel boats—many different types and sizes—can be bought at almost all good toy stores. They go swiftly through the water driven by a screw propeller and strong, long running motor. The boats shown in the picture are Ives Boats—

made by American workmen—the best in the world.

You can have loads of fun with Ives Boats all summer long in ponds, brooks or at the seashore. There are ocean liners, freighters, tugs, yachts, destroyers and submarines that dive. All are powerful, finely painted—exact models of the real ones. You can build wharves, docks, canals and harbors, and have great sport.

Send 4c in stamps for our fine book, "Ships and Shipping," which is full of illustrations and information about the American Merchant Marine, nautical terms, signals and rules of the sea, Ives Boats, etc.



**Ives Toys**  
Make Happy-Boys



## GET THIS BOOK

Send 4c in stamps for our fine book, "Ships and Shipping," which is full of illustrations and information about the American Merchant Marine, nautical terms, signals and rules of the sea, Ives Boats, etc.

**The Ives Manufacturing Corporation**  
191 Holland Ave., Bridgeport, Ct.

## Use this coupon

THE IVES MFG., CORPORATION  
191 Holland Ave., Bridgeport, Ct.  
Please send me your booklet "Ships and Shipping." I enclose 4c in stamps for postage and packing.  
Name .....  
Address .....  
City ..... State .....



# No Other Typewriter Can Do This



THE  
HEART  
OF THE  
HAMMOND

Over 365  
styles of  
types and  
languages  
to select  
from.

"Just turn  
the Knob"  
to change.

There are many typewriters but only one scientific "Writing Machine." Examine the varied types of the Multiplex below and you'll understand why.

**TWO STYLES OF TYPE, or two to five different languages, carried on the machine AT ONCE. "JUST TURN THE KNOB" and change instantly MULTIPLEX HAMMOND'S Instantly changeable type Many styles, many languages Two types or languages always in the machine Just Turn the Knob to change**

The above samples of type give but a slight idea of the versatility of one of the greatest achievements of science.

There is a special Multiplex that writes all the characters for higher and lower mathematics, gives chemical signs and symbols. That's why the



is the popular machine with mathematicians, astronomers, engineers, and with people in every walk of life.

**Mail Coupon for FREE BOOKLET "People Who Count" and "The Miracle of the Multiplex."**

## MAIL COUPON TO

HAMMOND TYPEWRITER CO., 639 E. 69th St.,  
New York City

Name: .....

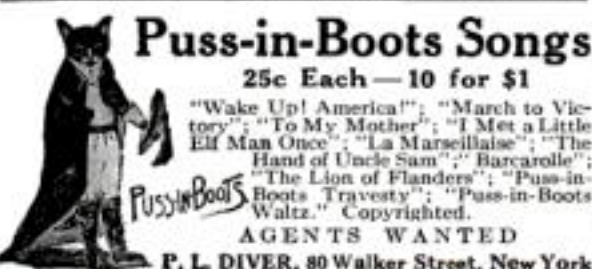
Address: .....



Violin, Hawaiian Guitar, Ukulele,  
Guitar, Mandolin, Cornet, Tenor Banjo or Banjo

Wonderful new system of teaching note music by mail. To first pupils in each locality, we give a \$20 superb Violin, Mandolin, Ukulele, Guitar, Hawaiian Guitar, Cornet, Tenor Banjo or Banjo absolutely free. Very small charge for lessons only. We guarantee success or no charge. Complete outfit free. Write now. No obligation.

SLINGERLAND SCHOOL OF MUSIC, Inc., Dept. 27, CHICAGO, ILL.



## Puss-in-Boots Songs

25c Each—10 for \$1

"Wake Up! America!"; "March to Victory"; "To My Mother"; "I Met a Little Elf Man Once"; "La Marseillaise"; "The Hand of Uncle Sam"; "Barcarolle"; "The Lion of Flanders"; "Puss-in-Boots Travesty"; "Puss-in-Boots Waltz." Copyrighted.

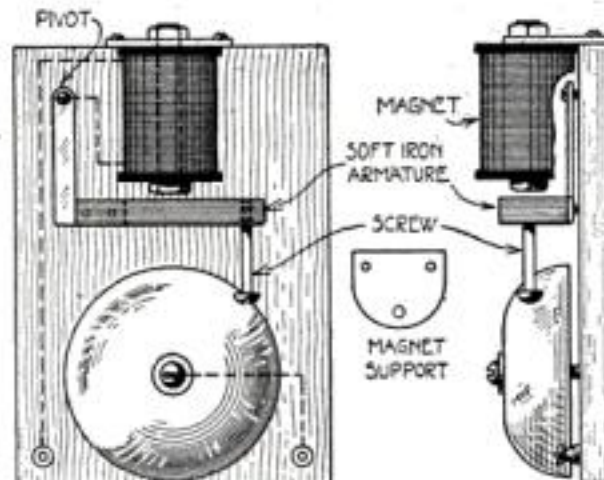
AGENTS WANTED

P. L. DIVER, 80 Walker Street, New York

**Arithmetic of Electricity**—A practical treatise on electrical calculations of all kinds reduced to a series of rules. \$1.00 Postpaid. Popular Science Monthly, 225 West 39th St., New York.

The armature consists of a piece of soft iron about 2 in. long and  $\frac{1}{2}$  in. wide. To the back of one end is screwed a piece of stiff brass with a vertical leg extending up 1 in. or more, having a round hole near the top. A long brass screw is set in the under side of the opposite end of the armature, and acts as the hammer. The head of this screw should touch the bell when the armature is about  $\frac{1}{8}$  in. below the magnet.

Set two binding posts in the bottom corners of the base, and connect one



There are no springs or adjustments to get out of order in this homemade electric bell

with bell-wire to the bell-post, and the other to one magnet terminal. The other magnet terminal must then be connected with the pivot-screw on which the armature is suspended.

The action is obvious. As the current from the battery enters one binding-post, it travels up to the magnet, down through the armature into the bell, and out at the opposite binding-post. This energizes the magnet which raises the armature. Then the circuit is broken, and the hammer drops to the bell, ringing it, and again energizing the magnet as the circuit is again closed. This action is repeated as long as the circuit is closed.

## Saving Eyes and Time in Concrete-Drilling

**I**N drilling into concrete, brick, or stone with a star-drill, the ease and speed of the cutting depend entirely upon how clean the hole is kept of the dust and particles of material that gather at the bottom of it. In overhead drilling this removal of the dust is accomplished by gravity, and the point of the drill is always clear. The work can thus be done in much less time than when the hole is being drilled in such a position that the drill has to be removed after every few strokes of the hammer, and the dust scraped out.

If the hole is of a size to allow the removal of the dust with the finger or a bit of wood, it is not so bad; but when the hole is very small, or is being drilled downward, it takes more time than do two or three overhead. If the worker uses his mouth to blow out the dust, his eyes usually suffer.

A good way to remove the dust is to blow it out with the aid of one of the

## HOW TO SELL YOUR REAL ESTATE



## This FREE Book

tells how you can get cash for your property by using the *Simplex Plans for selling Real Estate*, which have already sold more than 5,000 properties of all kinds in the U. S. and Canada. No matter where your property is located, these successful plans will show you how to sell it yourself, without employing agents or paying commissions to any one. Don't spend a minute's time, an ounce of effort or a cent of money trying to sell without first reading this important book, and learning how to sell your property quickly, economically and at the highest possible price. The

### Quick Results!

"Sold my house within two weeks by following the Simplex Plans."—F. Stark, Wis. "Sold for cash in 10 days."—W. H. Carlisle, Mass. "Sold my property. Your plan quickest I ever saw."—Johnson String, N. J. "Sold my home for cash within three weeks."—M. E. Lounsbury, Okla. "Sold my lots for cash."—R. P. Moodie, Ottawa, Can. "Sold for cash within a few weeks."—M. P. Jones, Iowa.

reading of this book has saved property owners hundreds and thousands of dollars in commissions, and it can do the same for you. As the book is sent absolutely free, you have everything to gain and nothing to lose. Send your name and address at once—a postal will do—and you will receive by return mail, postpaid, a copy of this important book, without cost or obligation.

**The Simplex Co.**  
Dept. 249  
1123 Broadway, New York

## DIAMONDS WATCHES ON CREDIT

### Send for Free Catalog

There are 128 illustrated pages of Diamond Rings, Diamond La Valieres, Diamond Ear Screws, Diamond Scarf Pins, Diamond Studs, Watches, Wrist Watches; also our wonderfully showy assembled Solitaire Diamond Clusters.

**EVERY ARTICLE IN OUR CATALOG** is specially selected and priced unusually low. Whatever you select will be sent prepaid by us. You see and examine the articles right in your own hands. If satisfied, pay one-fifth of purchase price and keep it, balance divided into eight equal amounts, payable monthly.

### Diamond Rings

We are offering wonderful values in Diamond Rings, Solitaires and Clusters, in all the popular mountings, plain and fancy engraved, at \$40, \$50, \$75, \$85, \$100, \$150 and up. Credit terms, one-fifth down, balance in eight equal amounts, payable monthly.

**Watches** Our Catalog illustrates and describes all the standard world-renowned Watches—solid gold and gold filled cases. Splendid bargains in 25-year guaranteed Watches on credit terms as low as **\$2.50 a Month.**

LIBERTY BONDS ACCEPTED

**LOFTIS** The National Credit Jewelers  
Dept. A-871 108 N. State St.  
CHICAGO, ILL.  
BROS. & CO. 1223 STORES IN LEADING CITIES



## The SHAW Motorbicycle

A dependable, easy running, speedy, high power motorbicycle at low cost. Chain drive. 90 to 125 miles on a gallon of gasoline. Absolutely guaranteed. Write at once for full information, also about the Shaw Attachment—makes your old bike a motorbicycle. SHAW MFG. CO., Dept. 466 GALESBURG, ILL.

**FREE SERVICE TO TEACHERS** Do you know that POPULAR SCIENCE MONTHLY prepares and sends Free, Service Sheets each month to teachers. Let us be your Liaison Office between the classroom and real life. There is no cost to you for this service. If you want to put a real "Punch" into your classroom work write to Popular Science Monthly, 225 W. 39th St., N. Y.



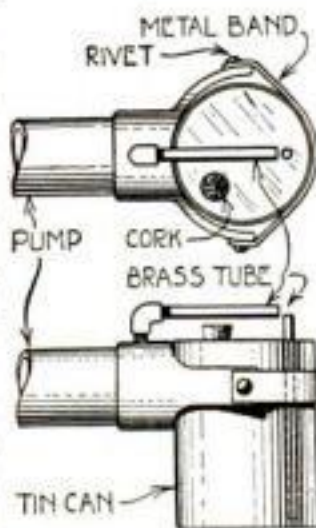
pocket variety of bicycle tire-pumps, or with a rubber syringe. Sometimes it is easier to flush it out with water squirted forcibly into the hole. For either the blowing process or the flushing, both tire-pump and syringe may be used.

## A Tin Can and a Bicycle-Pump Make a Spray-Gun

**A**N old bicycle foot-pump, a tin can, and a few odds and ends will make a very good spray-gun for use in the poultry-yard or garden.

Procure a can large enough to hold at least a pint. A condensed milk can that has two small holes punched in the top is best. Saw off the bottom part of the foot-piece on the pump, and fit the can in the two semicircular arms, as shown in the illustration; then clamp the can and arms together with a band of sheet metal.

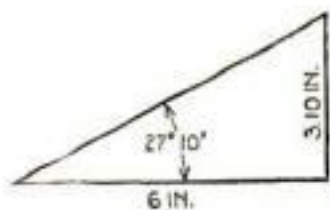
Solder a small brass tube about an inch in length to the bottom of the can, and another tube to the air outlet of the pump in such a manner that the air-blast blows directly across the top end of the 1 in. tube. Fit another hole with a cork to permit the can to be filled with liquid.—J. P. LEWIS.



This time of the year insects are beginning to eat up your garden crop. Use this home-made spray-gun to exterminate these pests

## Laying Out Accurate Angles by a Table of Tangents

**I**N the diagram is shown an angle of  $27^{\circ} 20'$ , laid off by making use of a table of tangents. Such a table is inexpensive and readily procured, and it finds a place, too, in every engineer's handbook.



The angle of  $27^{\circ} 20'$  was laid out by using a table of tangents in the manner described

Having consulted such a table, we see at once that the tangent for the angle in question is 0.5169. This value must be multiplied by the base of the triangle, a line the length of which is chosen arbitrarily, the longer the better. Six inches has been chosen in the present instance, and six times the tangent gives 3.10 inches, a dimension which is laid off on the perpendicular, as shown. Then the point on the perpendicular is connected with the other end of the base line, and the angle is formed.

Ten inches would be a better base

# The World of Industry Needs DRAFTSMEN



## You Can Learn Quickly By Our Practical Method

If you are a person of even average ability you can master this profitable profession in your spare time at your own home through our famous "Home Study Course." You can, in a short time, become a first class Draftsman because our training is most thorough and practical and because you will be personally instructed and coached by the President of the school, Roy C. Claffin, whose long experience as a draftsman and a teacher especially qualifies him to give you the kind of training you need. We teach you to make drawings just as you would in an actual drafting room, and when you finish our regular Mechanical Drafting Course you are given your choice of one of our Special Post Graduate Courses without extra cost.

## Draftsmen Get \$35.00 to \$100.00 a Week

On account of the importance of his work, the Draftsman is paid an excellent salary and is always in line for advancement. Drafting is not only one of the best paying professions, but is the stepping stone to bigger opportunities. Many men, receiving up to \$40,000 a year and over in technical positions, owe their success to their knowledge of Drafting. General construction companies, manufacturers of machinery, locomotives and automobiles, designers of tools and special equipment, makers of aeroplanes, large engineering companies, in fact all branches of industry need Draftsmen today in greater numbers and at better salaries than ever before.

## "Columbia" Graduates are the Kind of Draftsmen that are Needed

The properly trained Draftsmen, such as those graduated from the COLUMBIA SCHOOL OF DRAFTING, are the ones who get the preferred positions and best salaries. The success of our graduates proves this to be true. Columbia Graduates are filling important positions as professional Draftsmen throughout the country and prominent concerns are continually offering positions to our graduates.

## No Previous Training Required

As our students are given practical Drafting work from the beginning of our course, no previous training or drafting experience of any kind is required to take up this work with us. The training we give you is all that is needed to secure a position as Draftsman.

## Drawing Outfit Furnished Students

We furnish, without extra charge, an individual drawing outfit to all our students for use throughout the course. This becomes your own property as soon as the course has been paid for.

## SEND THIS COUPON TODAY

or write to  
COLUMBIA SCHOOL  
OF DRAFTING

Roy C. Claffin, Pres.  
Dept. 1130,  
14th & T Streets, N. W.,  
Washington, D. C.

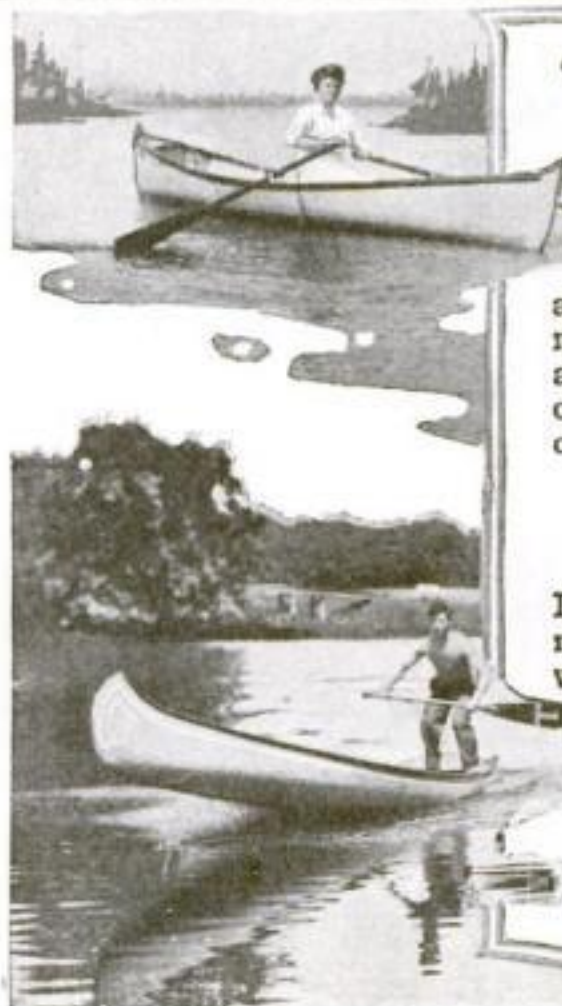
COLUMBIA SCHOOL OF DRAFTING  
Roy C. Claffin, President  
Dept. 1130, 14th & T Streets, N. W.,  
Washington, D. C.

Without obligation to me, please send me FREE your illustrated book of particulars, testimonials from students, rates and liberal terms.

Name.....

Street and No.....

City..... State.....



## This Rowboat Is Always Light

The Mullins steel boat cannot waterlog—it's always easy to row. Air compartments fore and aft make it unsinkable. Steel hull can't leak, dry out or open at the seams. Never needs calking—no boat house required.

## MULLINS STEEL BOATS CAN'T SINK

Designed by America's foremost naval architects. Built in the world's largest boat factory. More than 70,000 in use.

Write for catalog listing over 40 models of steel and wooden rowboats, canoes and power boats.

THE MULLINS BODY CORPORATION  
BOAT DEPT.  
619 Franklin St. SALEM, OHIO



# PATENTS

**IF YOU HAVE AN INVENTION** which you wish to patent you can write fully and freely to Munn & Co. for advice in regard to the best way of obtaining protection. Please send sketches or a model of your invention and a description of the device, explaining its operation.

All communications are strictly confidential. Our vast practice, extending over a period of seventy years, enables us in many cases to advise in regard to patentability without any expense to the client. Our Hand-Book on Patents is sent free on request. This explains our methods, terms, etc., in regard to Patents, Trade Marks, Foreign Patents, etc.

## If you are a reader of SCIENTIFIC AMERICAN

you are probably aware of the fact that it has a special appeal to the inventor. Each issue contains a description of a large number of recently patented inventions. Pending patent legislation as well as the most recent rulings of the Patent Office and the courts are considered in its columns.

## MUNN & CO.

SOLICITORS OF PATENTS

683 Woolworth Building, New York  
624 F Street, Washington, D. C.  
Tower Building - Chicago, Ill.  
Hobart Bldg., 582 Market Street,  
San Francisco, Calif.

## CAN YOU

think of a simple, practical idea that will fill one of the many requests we have on file for new inventions? It may mean a fortune for you. Thousands of things are needed **RIGOR NOW**. Your brains can help. Send today for our great new book—"Inventions and Trade Marks, Their Protection and Exploitation"—and learn more about making money from ideas than you ever knew before. It tells many things that are wanted, too. A postal will do—it is free.

We help our clients, without charge, to get the dollars out of their ideas—having facilities none others possess.

Advice free.  
Don't delay—get the book at once.

AMERICAN  
INDUSTRIES, INC.

201 Patent Dept.,  
WASHINGTON, D. C.

**PATENTS  
ADVERTISED  
For SALE FREE  
In INVENTION And  
MANUFACTURING  
SUPPLEMENT.**

Published for the  
man with an idea.  
Send for free sample  
copy. One year's subscription 50c.

## PATENTS PROCURED and TRADE-MARKS REGISTERED

Twenty Years' Experience. Instructions and Terms on request.

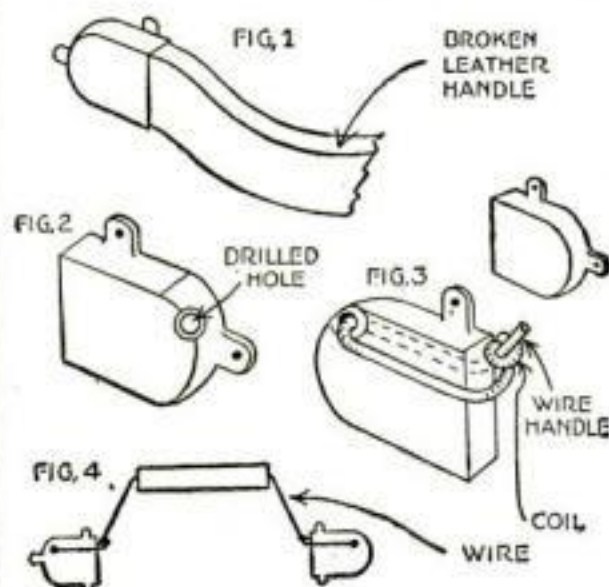
**ROBB, ROBB & HILL, Attorneys at Law**  
Specializing in Patent and Trade-mark Practice exclusively  
840 McLachlen Bldg., 1336 Schofield Bldg.,  
Washington, D. C. Cleveland, Ohio.

WANTED—A Representative in every factory in the United States. POPULAR SCIENCE MONTHLY, 225 West 39th Street, New York.

line than six inches, for, as every schoolboy knows, a number can be multiplied by ten simply by shifting the decimal point one place to the right. That would save us the operation of multiplying by six, and would also be more accurate. The method is rapid and can be applied by any one who has had even a very limited mathematical education.—H. C. RIDGELY.

## Attaching a Trunk-Handle to a Locked Trunk

**T**HE leather handle of a closely-packed trunk became broken (Fig. 1). The key was miles away, so a new handle had to be attached, and this had to be done without opening



Suppose your trunk-handle broke in transit and you didn't have the key? Could you fix like this?

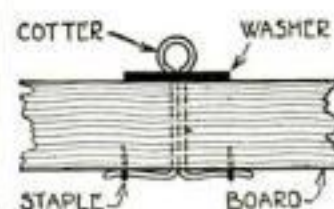
the trunk to clinch the handle-holding screws on the inside.

The leather was removed from the metal ends, and a hole drilled in each of them, as shown in Fig. 2. Then the loops of an ordinary wire handle were straightened, run through the metal ends and out of the holes, and coiled (Fig. 3). The satisfactory handle which was the result is shown in Fig. 4.

## How Eye-Bolts Can be Made from Large Cotter-Pins

**W**HEN small eye-bolts are needed, large-sized cotter-pins can be used to advantage as illustrated.

Bore a hole in the wood where the eye-bolt would be located. Place a



Here is the way to make a cotter-pin act as an eye-bolt

of the board after the eye has been forced down to the washer.

Clinch each leg of the cotter-pin to the wood by tacking a staple over it.

This device will stand a considerable pull and it makes a simple substitute for the eye-bolt.—WINDSOR CROWELL.

# PATENTS

## Free Book on Patents

Before applying for a patent write for a Free Copy of our book "How to Obtain a Patent," which contains valuable information and advice to inventors. It tells how to secure Patents. Send a model or sketch of your invention for our "Evidence of Conception" form and our opinion of its patentable nature—Free. Twenty years' experience in patent matters.

Write today for your  
**FREE BOOK.**

## TALBERT & TALBERT Patent Lawyers

4621 Talbert Bldg., WASHINGTON, D. C.

# PATENTS and Trade Marks

Send sketch or model for actual search and report. Write for Booklet of instructions on patent practice and procedure. Prompt personal service. . .

## Geo. P. Kimmel Patent Lawyer

39-G Loan and Trust Building, Washington, D.C.



## The Book for Inventors and Manufacturers

SIXTH EDITION  
By return mail **FREE.**  
Write **LACEY & LACEY**  
Dept. M Washington, D.C.

## BOUND VOLUMES OF POPULAR SCIENCE MONTHLY

Each volume contains over 2000 pictures, over 1500 new articles, making a handsome big book of 960 pages. Volumes available: Vol. 88, Jan.-June, 1916; Vol. 91, July-Dec., 1917; Vol. 92, Jan.-June, 1918; Vol. 93, July-Dec., 1918; Vol. 94, Jan.-June, 1919.

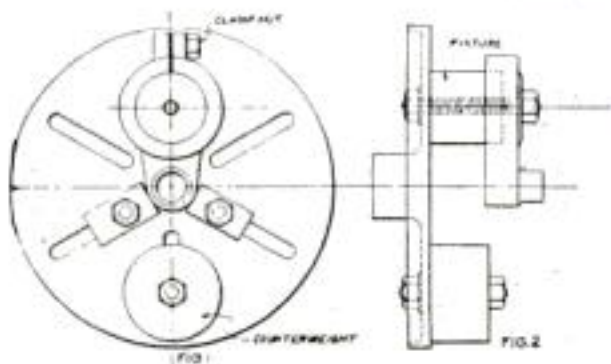
Price, per volume, postpaid, \$2.50.

Book Department,  
**POPULAR SCIENCE MONTHLY**  
225 West 39th Street, New York



## To Make a Hand-Power Milling Attachment

**A**MATEURS often find it necessary to cut slots or key-ways in shafting or shaft ends, slit bushings for expanding mandrels, shape square or hexagon heads on small bolts, etc.—work, that in the absence of a milling-

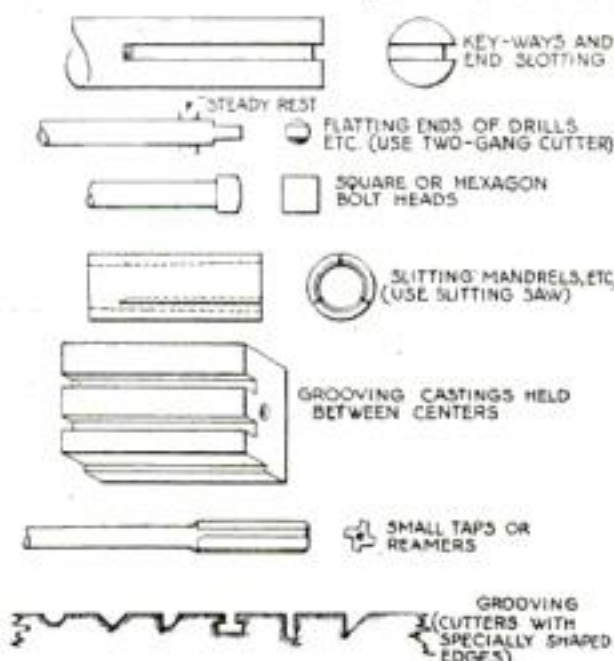


Figs. 1 and 2 show a method by which the cap and slide bearings may be bored

machine or shaper, must be done by hacksaw, file, and chisel, with more or less unsatisfactory results.

Here is a hand-power milling attachment that may be made complete on any small screw-cutting lathe. The key-way in the long upright column is cut by placing the column between centers, clamping the cutting tool on its side, and forming the keyway by running the tool-slide back and forth by hand. If shallow holes are drilled in series along the column before this operation, the process will be much easier on the lathe, as well as on the man who runs it.

No special dimensions have been given, for these will depend upon the size of the lathe for which the device is built. But clearance should be given for cutters not more than  $2\frac{1}{2}$  in. in diameter—it is impractical to use



The above illustration sets forth in detail the different parts necessary to make the milling attachment

anything larger for this small miller. As may be seen by the diagram, the device consists of a steel or cast-iron upright column, with a separate cap held on top by the bolt that clamps the column to the tool-slide of the lathe. This cap contains the upper bearing for the cutter spindle, the lower bearing being a casting that slides up and down on the column, adjusted by

# PATENTS TRADE-MARKS AND COPYRIGHTS

## SPECIAL OFFER FREE OPINION AS TO PATENTABLE NATURE

Before disclosing an invention, the inventor should write for our blank form "Evidence of Conception." This should be signed and witnessed and if returned to us together with model or sketch and description of the invention, we will give our opinion as to its patentable nature.



## Our Three Books Mailed Free to Inventors

Our Illustrated Guide BOOK

## HOW TO OBTAIN A PATENT

Sent FREE on Request

Contains full instructions regarding Patents, Trade-Marks, Foreign Patents. Our Methods, Terms, and 100 Mechanical Movements illustrated and described, Articles on Patent Practice and Procedure, and Law Points for inventors.

## OUR TRADE MARK BOOK

Shows the value and necessity of Trade-Mark Protection and gives information regarding unfair competition.

## OUR FOREIGN BOOK

We have Direct Agencies in all Foreign Countries. Write for our illustrated Guide Book on Foreign Patents.

## SPECIALIZATION Our Staff

The field of invention is so fast that it is impossible for any one man to become an expert in all the different classes of invention. Only those practically skilled in the class to which the invention relates are capable of rendering efficient service. For this reason Victor J. Evans & Co. employ a number of patent lawyers and mechanical experts who have been selected for their special knowledge and ability in certain lines of invention. Each case is placed in charge of experts in the classes in which the invention relates.

## THE VALUE OF YOUR PATENT

Will depend much upon the skill and care with which your case is prosecuted in the United States Patent Office. This work will receive the benefit of skill and experience acquired by a long and successful practice. We spare neither time nor pains to secure the broadest possible patents that the inventions will warrant. That every case entrusted to us receives our best efforts, and that our work is done consistently, skillfully and thoroughly is evidenced by the many unsolicited letters of commendation that we receive constantly from our clients. We will furnish upon request lists of clients from any State in the Union for whom we have secured patents.

## Our New York, Philadelphia, Pittsburgh, Chicago, and San Francisco Offices

Owing to the growth of our business we have established for the benefit of our clients Branch Offices in New York City, Philadelphia, Pa., Pittsburgh, Pa., Chicago, Ill., and San Francisco, Cal. These branch offices being located in these large commercial cities, together with our Main Office located near the U. S. Patent office, in Washington, enables us to more promptly handle the business of our clients, particularly as the branch offices are in constant touch with the Main Office and fully equipped to handle patent business in all its branches.

**Highest References—Prompt Attention—Reasonable Terms**

FREE COUPON

## VICTOR J. EVANS & CO. Patent Attorneys

New York Offices 1007 Woolworth Bldg. Philadelphia Offices 135 S. Broad Street Pittsburgh Offices 514 Empire Bldg.  
Chicago Offices, 1114 Tacoma Bldg. San Francisco Offices, Hobart Bldg.  
Main Offices, 760 9th Street, Washington, D.C.

Gentlemen: Please send me FREE OF CHARGE your books as described above.

Name..... Address.....



# U.S. PATENTS

**SEND FOR THIS FORM**

**DON'T LOSE YOUR RIGHTS TO PATENT PROTECTION**

Before disclosing your invention to anyone send for blank form "EVIDENCE OF CONCEPTION" to be signed and witnessed. A sample form together with printed instructions will show you just how to work up your evidence and establish the same before filing application for patent. As registered patent attorneys we represent hundreds of inventors all over the United States and Canada in the advancement of inventions. Our schedule of fees will be found reasonable. The form "Evidence of Conception," sample, instructions relating to obtaining of patents and schedule of fees sent upon request. Ask for them, —a post card will do.

**PATENTS AND TRADE MARKS**

**LANCASTER & ALLWINE**

274 Ouray Bldg.  
WASHINGTON, D. C.  
Originators of forms "Evidence of Conception."

## The Patent Institute

AN INSTITUTION Founded upon the Principle of Protecting the Inventor in His solution of the problem of mechanically developing his invention.

A RELIABLE MEDIUM Affording Engineering and Technical service for the development of inventions.

AN ORGANIZATION Co-operating with Engineers of the highest integrity for advising Inventors concerning practical questions of commercial construction.

Write for information.

THE PATENT INSTITUTE, WASHINGTON, D. C.

## LEARN ENGINEERING

Expert electrical engineers are being paid fabulous salaries—thousands needed today. We give you personal and thorough training—practical, technical courses 3 months to 2 years under expert engineers in electricity, steam, gas, armature winding, drafting, etc. Extensive laboratory and shop equipment. Not a trade school. Training is condensed—if your time is limited come to the **Finlay Engineering College**—only one of its kind in the West. Day and night sessions—enroll any time. Write for FREE catalog, a post card will do.

**FINLAY ENGINEERING COLLEGE**  
1092 Indiana Ave. Kansas City, Mo.

# PATENTS

## To the Man With an Idea

I offer a most comprehensive, experienced, efficient service for his prompt, legal protection and the development of his proposition.

Send sketch, or model and description, for advice as to cost, search through prior United States patents, etc. Preliminary advice gladly furnished without charge.

My experience and familiarity with various arts, frequently enable me to accurately advise clients as to probable patentability before they go to any expense.

Booklet of valuable information and form for properly disclosing your idea, free on request. Write today.

**RICHARD B. OWEN**  
Patent Lawyer  
6 Owen Building, Washington, D. C.  
2276-D Woolworth Building,  
New York City

DO YOU KNOW EVERY MOVE YOUR ATTORNEY MAKES?

## INVENTORS

My clients are immediately informed of every step in the prosecution of their applications.

Write Now **PATENTS** Send Sketch

Free Booklet on request

Office of **WARNER I. CUBBERLEY**, Patent Attorney  
20 National Union Bldg., Wash., D. C.

## WILLIAM C. LINTON

Consulting Engineer and Patent Attorney

"Inventor's Adviser" Mailed free on request. Gives full information as to Patents, Trade Marks and Their Cost

OFFICE

364 UNIVERSITY ST.,  
Montreal, Canada.

916 F ST. N. W.,  
Washington, D. C.

## LANGUAGES QUICKLY LEARNED

ON ALL PHONOGRAPHS



"Like learning a tune—and as easy." Our disc Records repeat the correct accent and pronunciation until you know it. Family and friends enjoy language study by the **LANGUAGE PHONE METHOD** and Rosenthal's Practical Linguistics. The war has created unlimited opportunity. Prepare now to better your position, or increase your business. Brush up on the language you studied at school. Write for Booklet and Free Trial Offer.

**THE LANGUAGE PHONE METHOD**  
246 West 8<sup>th</sup> St., 354 Fourth Ave., N. Y.



\$1.00

Postpaid

Mailed in plain wrapper

AMERICAN PUB. CO., 617 Winston Bldg., Philadelphia

## SEXUAL KNOWLEDGE

ILLUSTRATED

By WINFIELD SCOTT HALL, M.D., Ph.D.

SEX FACTS MADE PLAIN

What every young man and

Every young woman should know

What every young husband and

Every young wife should know

What every parent should know

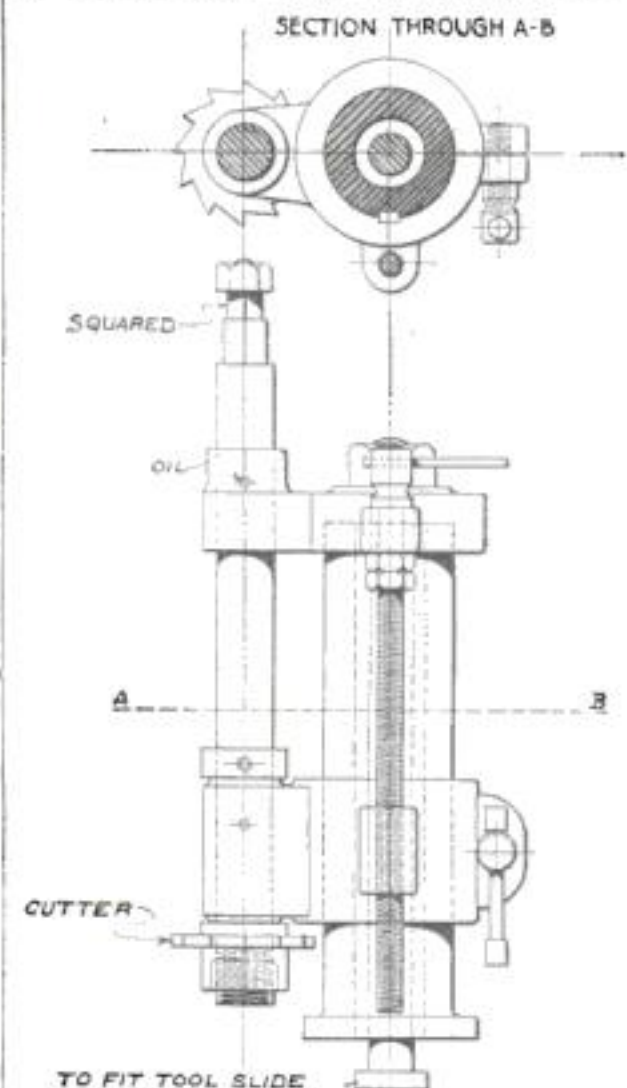
Cloth binding—320 pages—many illustrations

Table of contents, & commendations, on request.

AMERICAN PUB. CO., 617 Winston Bldg., Philadelphia

means of a long screw with a handle at the upper end, and that determines the height of the cutter.

This slide is provided with a sliding key fitted to an internal keyway (which must be chipped out by hand), and is split on one side, being held in position on the column by a clamping screw. In turning the spindle a collar is left on the lower end next to the cutter, and when in place a set screwed collar holds it in place in the slide bearing. The cutters are held to the spindle nose by a nut screwing up from below; with this nut keyways are unnecessary. The upper part of the spindle slides in the cap bearing as the slide moves up or down. Seven eighths of an inch is about the right diameter for the spindle; the diameter of the nose depends on the cutter hole. A 1/2-in. hole may be bored and



How the entire piece of apparatus will look when finished and ready to put in position

reamed in the lower end of the spindle to hold small end mills or other cutters.

Figs. 1 and 2 show a method by which the cap and slide bearings may be bored out so that they will line up. A short piece of shafting the same diameter as the upright column, upon which the slide should make a close sliding fit, is bolted to the face plate, and the slide, which has previously been bored out and split, is clamped to it as shown in Fig. 1. The shaft stub should be accurately squared up at both ends. After boring and reaming the slide bearing, this is removed without disturbing the stub, and the cap, which also has been previously faced off, and drilled for the center bolt, is bolted down (Fig. 2). Its bearing may now be bored and reamed, and if the work has been well done and the lathe is in good shape the two bearings

# PATENTS

IF YOU HAVE AN INVENTION and DESIRE TO LEARN HOW TO SECURE A PATENT, send for Our Guide Book, HOW TO GET A PATENT, sent Free on request. Tells our Terms, Methods, etc. Send model or sketch and description of your invention and we will give our opinion as to its patentable nature.

**RANDOLPH & CO.**  
130 F St., N. W., Washington, D. C.

NAME.....  
STREET.....  
CITY..... STATE.....



should be in line when the machine is assembled. If the holes are bored and reamed directly in the casting perfectly good bearings will result, bronze or babbitt bushings being unnecessary.

One form of operating handle is shown; a cast-iron arm and iron or steel handle turned up to fit it. For heavy work in cutting steel, a large tap-wrench may be fitted to the spindle in place of the crank, and both hands used to do the cutting.

In use, the device is clamped to the lathe-tool slide and the work held between centers, or, if the end is to be worked on, in the chuck or steady-rest. The cutter is fed to the work by means of the cross-slide and longitudinal feed given by hand to the tool-carriage. For end-slotting the cutter is fed across the work by the cross-slide. A good way to give an even longitudinal feed is to remove the feed-shaft gear and substitute a crank-handle, this being turned by one hand while the cutter spindle is turned by the other. For heavy work two persons are almost necessary, one to turn the cutter and one to manage the carriage; it would hardly be advisable to attempt a power feed unless the cutter were also driven by power.

This could be accomplished by building the column cap so that it would accommodate a worm-gear on the spindle-shaft, this being turned by a worm driven from an overhead counter-shaft. The spindle would have to be keywayed and a sliding key fitted to the worm, similar to the bevel gear drive on a drill-press spindle.

But for occasional work, such as the original is used for and such as the average amateur would do, this would be an unnecessary complication, the hand power having proved practical and allowing a great variety of cutting, grooving, facing work heretofore impossible of accomplishment on the lathe.—H. H. PARKER.


### You Can Make Your Own Vacuum Bottle

A VACUUM bottle of great value to nurses, travelers, and others can be made at small cost from waste materials.

A round cardboard box, such as some cereals come in, makes an excellent container. Cover the bottom and sides with oilcloth, allowing it to extend three inches above the top edge.

Line the sides of the box for 1½ in. with layers of newspapers. This surrounds the well in which the bottle is placed. Fill the well to a depth of two inches with torn bits of paper. Line the bottom and sides of this well with asbestos paper.

Procure a wide-mouthed, tightly corked bottle which will slip in and out of this well with ease. Care must be exercised in filling this bottle with hot food. If the bottle is placed in a pan of cold water and gradually heated, it may be filled with safety.—GRACE TOWNLEY.



## A Band like this—and You

TEN times as many bands as have ever been organized in any year of American history will be organized this year. There's opportunity for you. Get busy.


Any number of renowned virtuosos have built their fame with Conn Instruments. They are used and endorsed by the majority of the world's greatest artists.

They are famous for their ease of blowing, lightness in action, perfect intonation and tone quality, artistic design and finish. Choose any instrument from the 3,000 different classes that we manufacture, for six days' trial. A guarantee bond accompanies every Conn Instrument.


**FREE TRIAL—EASY PAYMENTS**

Only in Conn Instruments are the taper branches expanded by hydraulic pressure. This makes them smooth as glass inside which means perfect intonation and easy carriage of sound waves.

**FREE BOOK.** Mention instrument in which you are interested and we will send a special booklet and beautiful photo of it—free. Conn Instruments can be quickly mastered.



**CONN LTD**  
532 Conn Bldg. Elkhart, Ind.  
Branches in all large cities



WORLD'S LARGEST MANUFACTURERS OF BAND AND ORCHESTRA INSTRUMENTS

### Wrestling Book FREE

Learn to be an expert wrestler. Know scientific wrestling, self-defense, and jiu-jitsu. Develop a splendid physique, and have perfect health. Join this popular school and learn by mail. The famous world's champions—the marvelous **Frank Gotch and Farmer Burns** offer you a wonderful opportunity. Wrestling is easily and quickly learned at home by mail. Men and boys write now for splendid free book. Learn all the science and tricks. Be able to handle big men with ease. Accept this wonderful offer NOW. Send for free book today, stating your age.

Farmer Burns School of Wrestling. A-129 Ramo Bldg., Omaha, Neb.

**\$3,000.00 IN ONE YEAR**

This Bunch of Tires Will Make Several Dollars Profit

Make it repairing automobile tires by the new method of **Tire Surgery**. Punctures and blow-outs are common. Tires need retreading and vulcanizing. Each Auto Sold Means More Tire Trouble.

Auto Tire Surgery field a hundred times bigger and better than old bicycle days. Oldham, Ill., writes: "Earned \$2,200 in four months." Investigate today. Ask for FREE catalog.

**Haywood Tire & Equipment Company**  
1276 Capitol Ave., Indianapolis, Ind.

### I NEED BRANCH MANAGERS

Will pay big money to men with autos. Install Rideezee, the **BETTER THAN AIR INNER TIRE**. Cheaper than tubes, a light resilient substance guaranteed ten years. Equip your car at agent's price. Sell to friends. The business of the future.

**RIDEEZEE CO., ST. PAUL, MINN.**

### Battery Charging Your Biggest Money-Maker

Make \$150 to \$350 Profit Every Month

This HB Charger brings Big Opportunity. Recharges 32 6-volt batteries, or equivalent, at one time. Cost 10c to 15c each. Owner pays 75c to \$1.50—figure the profits. You can make **BIG PROFITS** and build a permanent business. Others are doing it—YOU can too.

Small Cash Payment Brings You This Money-Maker

Balance on easy monthly terms. Profits easily pay for outfit. Absolute Money Back Guarantee. No expensive repairs or replacements. Runs 24 hours a day. Big, steady, profitable income. Write TODAY for full information.

**Hobart Brothers Company**  
Box 563 Troy, Ohio  
Successful Mfrs. Since 1888

**HB 2KW Generator Set**



**Earn \$2,500 to  
\$5,000 a year**

## Be a Signal Engineer

Qualify at home in spare time for a big position as Signal Engineer. Get into this great new field of fascinating work where quick success, swift promotion and a high salary await you. Railroads everywhere need men who understand Signal Engineering and electrical safety devices.

### Book FREE

Send quick for big illustrated Book on Signal Engineering and details of our great Free Outfit Offer and our wonderful system of training which includes a Complete Course in Practical Electricity and Mechanical Drafting. Send postal to day. Don't delay! Get it now!

DEPARTMENT OF SIGNALING, Dept. B-1206  
1924 Sunnyside Ave., Chicago, Ill.



## Finger Print Detectives Wanted



**M**EN are wanted by the government, police departments, corporations, banks, institutions and individuals—these men must be trained Finger Print Men—men who have made this work a profession.

## Big Salaries

and big rewards go to these experts because they solve mysteries that baffle the most experienced ordinary detectives. The finger print clew is one that cannot fail because no two people in the whole world make the same mark.

## You Can Succeed

in mastering this fascinating, big money-making profession by studying in your spare time at home. Common school education is all you need. A brilliant career is before you. Finger Print experts travel everywhere, see the country, live in the best hotels and have all expenses paid. There is a crying need for such men right now. This profession is not crowded. Get started at once—right now—and be one of the big men in the field. Get our free book today.

## Mail the Coupon Right NOW!

Fill in this coupon and mail it right now. This may be the big opportunity of your life, so don't waste another minute. When you send the coupon we will send you our

### Free Finger Print Book

Tells you all about finger prints—the big opportunities in this profession, and everything you want to know about it. Send the coupon now.

University of Applied Science

Desk A-920. 1920 Sunnyside Ave., Chicago

Please send me Free Book on Finger Prints and full information about your course of study.

Name.....

Address.....

Age..... Occupation.....

# The Neatest Mechanical Job I Ever Saw

The Popular Science Monthly will pay  
ninety dollars for the best answers

**W**HAT was the neatest mechanical job you ever saw, and how was it done? Some neat ones recently described in the POPULAR SCIENCE MONTHLY were: A broken overhead shaft repaired without removing it. A magneto brush made from an old pencil. Tight pulleys quickly bushed. The action of a drill in soft metal made easy. Worn screws made as good as new. There are, of course, many other neat jobs, and we want to know in how many other practical ways they can be done. Tell us! The POPULAR SCIENCE MONTHLY offers three prizes,—a first prize of \$50, a second prize of \$25, and a third prize of \$15,—to be awarded in accordance with the rules set forth below.

## Rules Governing the Contest

(1) Contestants are not limited to the number of neat jobs, but only one method can possibly win the first prize, only one the second, and only one the third. The contest is open to everybody.

(2) The method must be clearly shown either in a photograph or in a drawing. If a drawing is sent in, it need not be made by a skilled draftsman. It is sufficient that it should be intelligible. While pencil sketches will be considered, contestants are requested to make their drawings in ink on heavy white paper. The views should be sufficient in number to set forth the use of the appliance very clearly. The contestant's name and address should appear on each sheet of drawings.

(3) The drawings or photographs must be accompanied by a description, preferably typewritten, in which the method is clearly given. It must be written on one side of the paper only, and it should not be more than 500 words in length. The name and address of the contestant should appear in the upper left-hand corner of the first sheet of the written description.

(4) The drawings and description entered by contestants must be received by the POPULAR SCIENCE MONTHLY not later than 5 p. m. on Saturday, July 31, 1920.

(5) The judges of the contest will be the editors of the POPULAR SCIENCE MONTHLY.

(6) The first prize of \$50 will be awarded to the contestant who, in the opinion of the judges, has suggested the simplest and neatest job.

The second prize of \$25 will be paid to the contestant who submits a method next in merit.

The third prize of \$15 will be paid to the contestant who submits the method third in merit.

(7) The winners of the contest will be announced in the earliest possible issue of the POPULAR SCIENCE MONTHLY. A description of the methods which win the three prizes offered will duly appear in the pages of the POPULAR SCIENCE MONTHLY, together with the names of the winners.

(8) The editors of the POPULAR SCIENCE MONTHLY shall have the right to publish meritorious manuscripts which do not win a prize. The regular space rates will be paid to the contestants who submit the manuscripts thus selected.

(9) When a contestant submits more than one method, the description and drawing by which each is set forth must be sent as a separate unit.

(10) Manuscripts or drawings will be returned to contestants if stamps are enclosed.

(11) Send drawings and specifications to the Neatest Job Editor, POPULAR SCIENCE MONTHLY, 225 West 39th Street, New York City.





## "The Job is Yours— on One Condition!"

"For a long time I watched the new men who came into this business. Some stood still—stayed right where they started. Others climbed—made each job a stepping stone to something better.

"Now, what was the difference? Well, I investigated and found out. The men who were getting ahead had been devoting part of their spare time to study along the line of their work. Our treasurer used to be a bookkeeper. The factory superintendent was working at a bench in the shop a few years ago. The sales manager started in a branch office up state. The chief designer rose from the bottom in the drafting room.

"All of these men won their advancements through spare time study with the International Correspondence Schools. Today they are earning four or five times—yes, some of them *ten* times as much money as when they came with us.

"So out of this experience we have formed a policy. We are looking for men who care enough about their future not only to do their present work well, but to devote part of their spare time to preparation for advancement.

"And I'll give you this job on one condition—that you take up a course of special training along the line of your work. Let the I. C. S. help you for one hour after supper each night and your future in this business will take care of itself."

Employers are begging for men with ambition, men who really want to get ahead in the world and are willing to prove it by training themselves in spare time to do some one thing well.

Prove that you are that kind of a man! The International Correspondence Schools are ready and anxious to help you prepare for advancement in the work of your choice, whatever it may be. More than two million men and women in the last 28 years have taken the I. C. S. route to more money. Over 100,000 others are getting ready in the same way right now. Surely the least you can do is to find out what there is in this proposition for *you*. Here is all we ask: Without cost, without obligating yourself in any way, simply mark and mail this coupon.

### TEAR OUT HERE INTERNATIONAL CORRESPONDENCE SCHOOLS BOX 7679, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

- |                                                         |                                                  |
|---------------------------------------------------------|--------------------------------------------------|
| <input type="checkbox"/> ELECTRICAL ENGINEER            | <input type="checkbox"/> SALESMANSHIP            |
| <input type="checkbox"/> Electric Lighting and Railways | <input type="checkbox"/> ADVERTISING             |
| <input type="checkbox"/> Electric Wiring                | <input type="checkbox"/> Window Trimmer          |
| <input type="checkbox"/> Telegraph Engineer             | <input type="checkbox"/> Show Card Writer        |
| <input type="checkbox"/> Telephone Work                 | <input type="checkbox"/> Sign Painter            |
| <input type="checkbox"/> MECHANICAL ENGINEER            | <input type="checkbox"/> Railroad Trainman       |
| <input type="checkbox"/> Mechanical Draftsman           | <input type="checkbox"/> ILLUSTRATING            |
| <input type="checkbox"/> Machine Shop Practice          | <input type="checkbox"/> Cartooning              |
| <input type="checkbox"/> Toolmaker                      | <input type="checkbox"/> BUSINESS MANAGEMENT     |
| <input type="checkbox"/> Gas Engine Operating           | <input type="checkbox"/> Private Secretary       |
| <input type="checkbox"/> CIVIL ENGINEER                 | <input type="checkbox"/> BOOKKEEPER              |
| <input type="checkbox"/> Surveying and Mapping          | <input type="checkbox"/> Stenographer and Typist |
| <input type="checkbox"/> TIRE FOREMAN OR ENGINEER       | <input type="checkbox"/> Cert. Public Accountant |
| <input type="checkbox"/> STATIONARY ENGINEER            | <input type="checkbox"/> TRAFFIC MANAGER         |
| <input type="checkbox"/> Marine Engineer                | <input type="checkbox"/> Railway Accountant      |
| <input type="checkbox"/> Ship Draftsman                 | <input type="checkbox"/> Commercial Law          |
| <input type="checkbox"/> ARCHITECT                      | <input type="checkbox"/> GOOD ENGLISH            |
| <input type="checkbox"/> Contractor and Builder         | <input type="checkbox"/> Teacher                 |
| <input type="checkbox"/> Architectural Draftsman        | <input type="checkbox"/> Common School Subjects  |
| <input type="checkbox"/> Concrete Builder               | <input type="checkbox"/> CIVIL SERVICE           |
| <input type="checkbox"/> Structural Engineer            | <input type="checkbox"/> Railway Mail Clerk      |
| <input type="checkbox"/> PLUMBING AND HEATING           | <input type="checkbox"/> AUTOMOBILE OPERATING    |
| <input type="checkbox"/> Sheet Metal Worker             | <input type="checkbox"/> Auto Repairing          |
| <input type="checkbox"/> Textile Overseer or Supt.      | <input type="checkbox"/> Navigation              |
| <input type="checkbox"/> CHEMIST                        | <input type="checkbox"/> AGRICULTURE             |
| <input type="checkbox"/> Mathematics                    | <input type="checkbox"/> Poultry Raising         |
|                                                         | <input type="checkbox"/> Spanish                 |
|                                                         | <input type="checkbox"/> French                  |
|                                                         | <input type="checkbox"/> Italian                 |

Name \_\_\_\_\_  
 Present Occupation \_\_\_\_\_  
 Street \_\_\_\_\_  
 and No. \_\_\_\_\_  
 City \_\_\_\_\_ State \_\_\_\_\_

Canadians may send this coupon to  
 International Correspondence Schools, Montreal, Canada

7-25-19





# For the Radio Experimenter



## The Thermionic Oscillator—III

By H. J. van der Bijl, M. A., Ph. D.

THE principles involved in the production of sustained oscillations with the thermionic vacuum tube have been explained in the previous article. The circuits shown there have been stripped of all parts, such as the batteries, that are not necessary to explain the operation

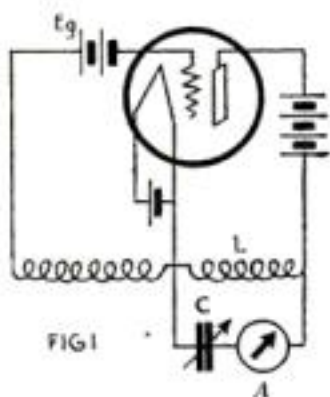


FIG. 1  
The simplest type of vacuum-tube oscillation circuit is shown in this diagram

of the tube in the production of oscillations. We shall now discuss some of the circuits actually used in practice, and here the batteries will be shown so that the diagrams represent circuits that can actually be used. There are a large number of different circuits in use at the present time, all of which are satisfactory, though some have advantages over others in certain respects.

### Simplest Type of Oscillation Circuit

Fig. 1 shows the simplest type of oscillation circuit, sometimes referred to as the "reversed feed-back circuit."

This circuit lends itself most readily to a mathematical solution, and is also in actual operation one of the simplest types. The oscillation current is established in the oscillation circuit LC and can be measured with the a.c. meter A.

A grid battery  $E_g$  is inserted in the grid circuit to maintain the grid at negative potential with respect to the filament. This is not always necessary, it being possible to make the tube operate satisfactorily without the grid battery. But it will usually be found that in general there is a certain grid potential that gives the best results and that should be determined experimentally. The frequency of the oscillations is

determined almost entirely by the inductance  $L$  and capacity  $C$  in the oscillation circuit; in other words, it is given by

$$\text{frequency} = \frac{1}{2\pi\sqrt{LC}}$$

Fig. 2 shows the circuit that is generally referred to as the feed-back circuit. The difference between this and the other one is that the condenser is in parallel with the grid inductance instead of with the plate inductance. This circuit is the type that is used to detect electromagnetic waves by the autodyne method. When used for this purpose the incoming oscillations are induced in the coil  $L$ , while the resonant circuit containing  $C$  and  $L$  are tuned to the frequency of the incoming oscillations, thus producing maximum potential variations between

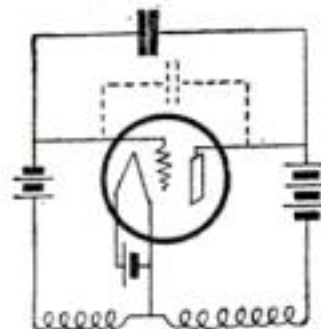


FIG. 2  
Here is the Hartley oscillation circuit, designed for generating high frequencies

the filament and the grid. The receiver may be inserted in the plate circuit, as shown in Fig. 3. It will be seen that Fig. 3 is the same as Fig. 2, except that Fig. 3 looks more familiar as the type commonly used to receive continuous waves.

### The Hartley Circuit

A type of oscillation circuit that is commonly used is shown in Fig. 4. This is known as the Hartley circuit. This arrangement is of value when producing very high frequencies.

The tube is not entirely free from reactance effects. There is, for example, an electrostatic capacity between the grid and the plate of the tube, and so also between the other elements. These electrostatic capacities are usually very small, but they become very effective when the frequency becomes very high. The effective capacity between grid and plate is indicated in Fig. 4 by the dotted line. In the Hartley cir-

cuit the condenser  $C$  connects the grid with the plate. It will, therefore, be seen from the figure that this condenser and the capacity between grid and plate are in parallel, so that they may simply be added. For very high frequencies the condenser  $C$  may be omitted altogether, and the tube will oscillate with a frequency depending on the inductance of the coil and the capacity between the elements of the tube.

In the arrangement shown in this diagram the grid is maintained at an appropriate negative potential by means of the grid battery  $E_g$ . The same thing may be done by means of a resistance leak  $R$ , as shown in Fig. 5.

As was before stated, this type of circuit is commonly used, and it will be found very satisfactory when it is desired to produce oscillations covering a very wide range.

There are two other types of circuit that should be mentioned here. The first is the Colpitts oscillation circuit, which is shown in Fig. 6. In this diagram the batteries are omitted for the sake of clearness. Comparing Fig. 6 with Fig. 4, it will be seen that

the inductance in the Colpitts circuit takes the place of the capacity in the Hartley circuit, and the inductances in the Hartley circuit are replaced by condensers in the Colpitts circuit. A convenient way to use the Colpitts circuit in actual practice is shown in Fig. 7.  $C_L$  represents choke coils to pass direct current, the plate battery being inserted as indicated by  $E_B$ .

The condensers  $C_1$  and  $C_2$  are added to prevent direct current from flowing through the inductance  $L$ . In other words, the choke coils and these condensers are inserted to separate the d.c. from the a.c. circuits.

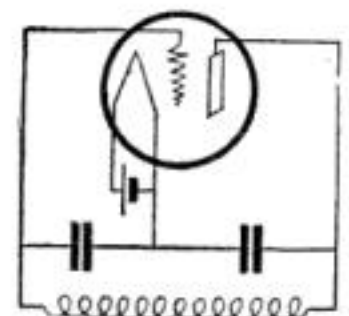


FIG. 6  
The Colpitts oscillator shown above uses a single coil and two condensers

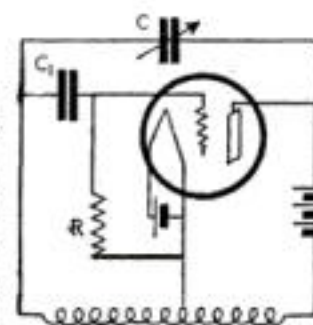


FIG. 5  
The grid-leak oscillation circuit maintains a negative potential on grid

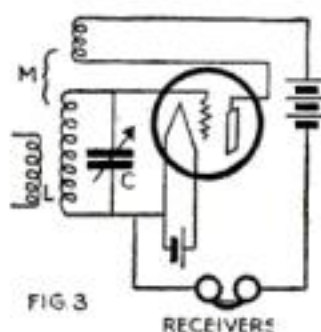


FIG. 3  
RECEIVERS  
The oscillation circuit shown in Fig. 2 is here adapted to radio receiving

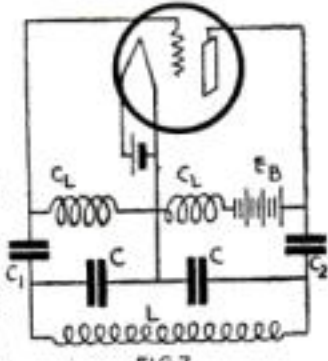


FIG. 7  
Showing the battery supply circuits that are used for the Colpitts oscillation



# Double tube frame and special spring fork

Eminently noteworthy among the structural achievements of the matchless INDIAN Scout, are the double tube frame and the special spring fork.

Since these units are closely allied in point of service, they are closely united in mechanical excellence. Super-sturdiness of build combined with lightness in weight, the prime essential of motorcycle perfection, is common to both.

## Spring fork

Examine the truss-like construction of the specially designed leaf spring fork and you will see why it affords extreme flexibility and riding smoothness without any sacrifice of strength. The fork rockers are heavy drop forgings and are fitted with large screw-down lubricators. The specially designed leaf spring is highly resilient, and easily masters any road jolt.

## Double tube frame

The frame proper is made from steel tubes of the finest quality. From the frame-head two of these tubes diverge, forming a cradle for the unit power plant. The shape of the frame not only permits a three point suspension for the power-mechanism, but it acts, as well, as a self-bracing shock absorber.

The utmost in stress-resistance, both laterally and longitudinally, assures that these Scout members will safeguard the vital alignment of working parts. They form the backbone of the time-tried INDIAN hardihood. They are built to "stand the gaff," and their faithful adherence to this built-in idea merits the confidence they win everywhere.

Department 38

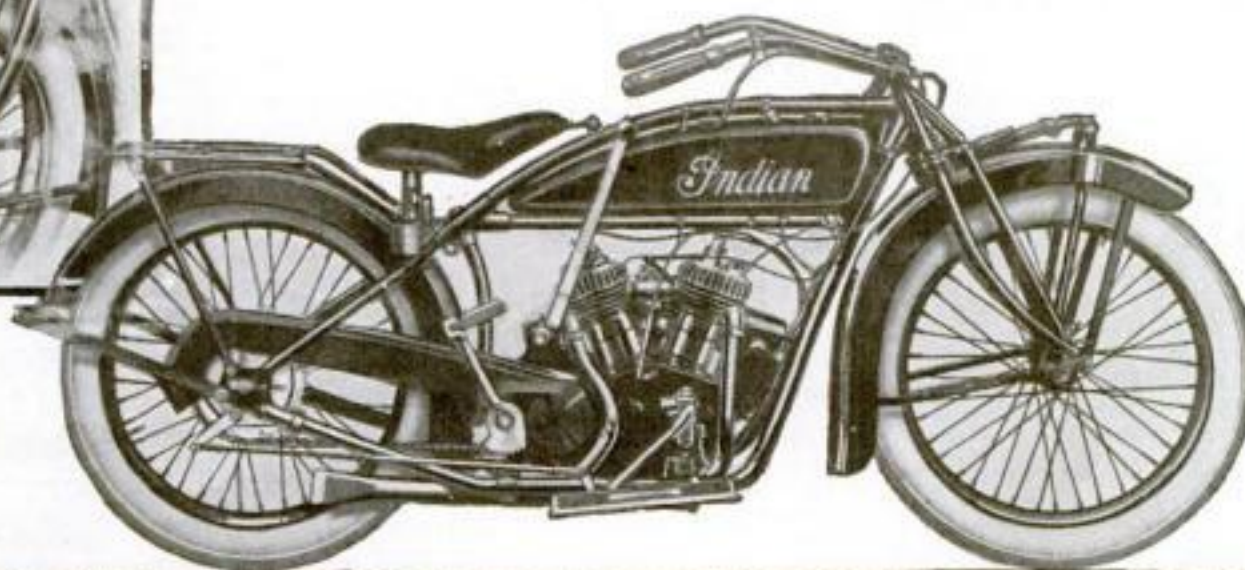
HENDEE MANUFACTURING COMPANY

Springfield, Mass.

*The Largest Motorcycle Manufacturer in the World*



INDIAN Scout  
Model G20



# Indian Motorcycle

*For Sale by Dealers Everywhere*



## THE FLORSHEIM SHOE



**FLORSHEIM**  
Oxfords are cool and perfect fitting—they fit snug at the ankle and hug the heel—made of quality materials that give you value for what you pay.

Consider the wear, not the price per pair

Look for the quality mark, "Florsheim."

The Florsheim Shoe Company  
CHICAGO, U. S. A.

Write for book  
"Styles of the Times"



## SAVE 1/2



Your "GAS" and ALL Your Trouble  
**15-DAY FREE TRIAL**  
Money-back Guarantee

Entirely NEW principle—not a moving part—Simple. Has the Pep and Power.

**U. & J. Carburetor**

Doubles Mileage—Guaranteed to start car in zero weather—No Priming. 50,000 delighted users. Now ready for Ford, Dodge, Maxwell and Overland. DEALERS—Service Stations, Salesmen: The "U. & J." sells on demonstration—installed in thirty minutes—some good open territory.

We also manufacture the U. & J. FORD TIMER. Will last as long as the car. PRICE \$2.50

**U. & J. CARBURETOR CO.**  
Dept. 231 - 507 W. Jackson Blvd., CHICAGO

## Build Your Own PHONOGRAPH

It's Easy With Our Help

A few hours' interesting work saves many dollars and gives you a machine exactly to suit your ideals. We furnish motors, tone arms, case material, blue prints and full instructions. Plans any record. You can make fine profit building phonographs for your friends.

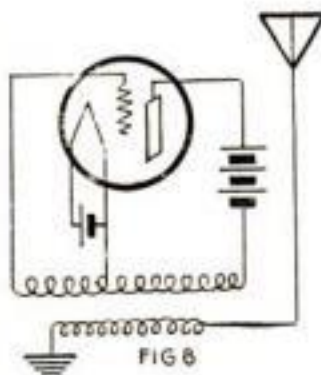
Write Today for Our Free Blue Print Offer

Agents wanted for our ready built phonographs  
Chas. Phonograph Co.  
606 Monger Bldg., Elkhart, Ind.



SAVE OVER HALF

When it is desired to impress these oscillations on an antenna, any one of the known means can be resorted to. The antenna circuit may, for example, be coupled up to the oscillation circuit. Fig. 8 shows the Meissner oscillation circuit and the way in which it is coupled to an antenna.



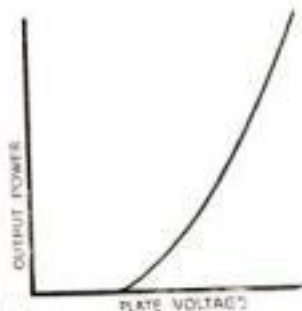
Showing the connection of the Meissner or oscillation circuit to the antenna

will give the best results. If the filament current is not high enough, the tube will give a small amount of power output in the form of alternating current, or it may not oscillate at all.

## Increased Current

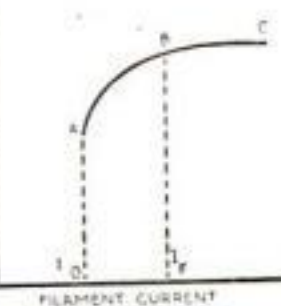
As the filament current is increased, the tube will suddenly start to oscillate when a certain value of filament current is reached. As the filament current is further increased, the strength of the oscillation current (as measured, for example, by the ammeter A in Fig. 1) will increase rapidly at first and then more slowly, and finally become virtually independent of the filament current. This behavior is shown in Fig. 9, which gives the out-power as a function of the filament current. The filament current should not be made any greater than is necessary, because this unduly shortens the life of the tube.

Now, suppose the filament current has a fixed value  $I_f$ . Unless the plate voltage is large enough, the tube will not oscillate, even though the filament current is large enough.



The power output depends upon the plate voltage, as shown here

reaches a certain value. Further increase in the plate voltage causes a rapid increase in the output power, provided the filament current is high enough. The plate voltage should be kept within certain limits, depending on the type of tube.



The power output is bound to vary if filament current is too low

Study **ENGINEERING** by Mail

Reinforced Concrete Engineering  
Structural Steel Designing  
Structural Drafting  
Concrete Drafting and Estimating

An A-1 Engineer with 30 years of experience has arranged these courses for technical men who do not "know it all" and for High School graduates who wish to take up this profession as a life work. It is really *private tutoring by mail*.

Prices moderate. Free literature: write for it IMMEDIATELY.

**Wilson Engineering Corp.,**  
Box 0, Hanover, Mass.

## STORAGE BATTERIES FOR ANY CAR

Starting Lighting

Guaranteed Nine to Eighteen Months  
No False Promises. Performance Counts

6 Volts rebuilt \$12 and your old battery or \$14.50 cash  
12 Volts rebuilt 17 and your old battery or 19.50 cash

**NEW 6 VOLT GUARANTEED 18 MONTHS \$21.00**

Economize in comfort with a BANNER BATTERY. Send twenty per cent deposit, balance C.O.S. subject to inspection.

**BANNER BATTERY CO.**  
1356 Michigan Ave. Chicago, Ill.

## AGENTS: \$60 a Week

taking orders for **Thomas Guarantee Shoes** for men, women and children. All styles. Brand new proposition—must wear and gives satisfaction or replaced free.



**CHEAPER AND BETTER THAN LEATHER**

Flexible steel arch shank. Heel can't come off. Get started at once. Have a steady income. No capital required. No competition. Write quick for Agency and territory. Big opportunity for men and women.

**Thomas Shoe Co., 647 Long St., Dayton, Ohio**

Ending Rats—Nice

## Write for this free booklet

It tells how you can rid your premises in three days of disease-carrying, damage-causing, food-destroying pests.

Rough-On-Rats is economical, easy to use—and sure. At drug and general stores.

**E. S. WELLS, Chemist**  
Jersey City, N. J.

## ROUGH ON RATS



**New Big No. 14-200pp. Wireless and 100 pp. Electrical Catalog**

Wireless catalog mailed for 12c and electrical catalog for 6c. You may deduct this amount on first \$1.00 purchase. Catalog not sent otherwise. Any wireless amateur will tell you it is the one catalog to have. As an encyclopedia of information it is invaluable. The largest and most elaborate radio catalog published. Values that cannot be duplicated elsewhere.

**THE WILLIAM B. DUCK COMPANY**  
212-214 Superior TOLEDO, OHIO

## BUCHSTEIN'S FIBRE LIMB

soothing to your stump—strong, cool, neat, light. Easy payments.



Guaranteed 5 Years  
Send for Catalog Today.

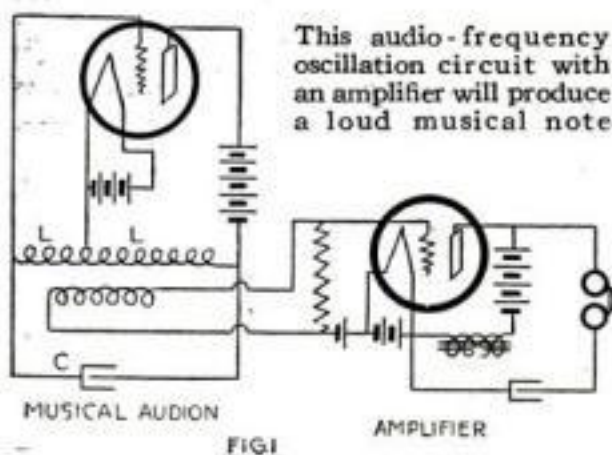
**P. BUCHSTEIN CO., 113 6th St., S., MINNEAPOLIS, MINN.**



## A Musical Scale from an Oscillating Audion

[So many operators were interested in our article in the January number which described how Dr. De Forest gets music from an audion that we shall give some rules for tuning an oscillating audion. If you are interested you will find it worth while to read again not only that article, but those recently published by Dr. van der Bijl on vacuum-tube oscillators, and also the discussion of "Stoppers and Filters for Undamped Waves" in the April number.]

**A**n oscillating audion coupled with an amplifying tube (Fig. 1) supplies the receivers of a loud-speaking re-



This audio-frequency oscillation circuit with an amplifier will produce a loud musical note

ceiver. The pitch of the note will depend upon the amount of inductance in the coil  $L$ , and of capacity in the condenser  $C$ , being lower the greater is the product of  $L$  and  $C$ . Hence, if we vary either  $L$  or  $C$  we vary the note. If we do so by the right steps we may make the audion give successively the notes of the musical scale.

In Dr. De Forest's hook-up he used one tube and one tuned circuit for each note; but he has more audions at his disposal than most of us, so we shall describe how to accomplish the result with one oscillating tube. Of course, we can't play chords as he can, but we can play simple old-fashioned melodies.

If we have condensers of known capacity and coils of known inductance, it is very easy to tune the oscillating circuit to give any desired musical note. We shall describe that method first, and then explain how it can be done if we have to deal with homemade coils of unknown inductance.

Suppose you wish to get a note of "middle C" which represents 256 vibrations a second. Choose  $L$  and  $C$  so that the product of the number of mil-henries of inductance by the number of microfarads of capacity is 389.

For example, if you have an iron core coil of, say, one henry, i. e., 1,000 mils, then you will need a condenser of 0.389 mf. But if your coil has only 50 mils your condenser must be 7.78 mf. You can obtain far better results by using a coil of large inductance.

Now, if you want the octave of middle C, namely the note of 512 vibrations a second, you must make this product one quarter as large. For example, if you are using the one-henry coil you now make the capacity only 0.097 mf.

# LEARN WIRELESS

## By Mail - In Ten Weeks



## Learn Wireless Telegraphy and Telephony At Home in Few Weeks

Calls coming in steadily for National Radio Institute graduates from all parts of the country. Four concerns guarantee to take all the operators we can furnish.

Commercial radio has arrived and many attractive positions are now open in the commercial land radio service, merchant marine, railroads, radio supply factories, lake and ocean steamship companies, telegraph companies, aerial mail service, and radio compass stations. We are now receiving requests for more National Radio Institute graduates than we can furnish.

### Instruments to Every Student

In addition to 5 text books, one hand book, 46 special lessons and 18 personal examinations, we send you, while taking our course, the fine natrometer outfit here pictured.

### Extra Course in Radio Telephony

In addition to our complete course in modern radio telegraphy, every student is given our complete course in Modern Radio Telephony. This course combines ten special lessons and ten personal examinations. This combined telegraphy and telephony course enables our students to secure positions requiring knowledge of both radio telegraphy and modern radio telephony.

Send This Coupon for FREE Book containing particulars of our special offer to students enrolling now.

### National Radio Institute

America's First and Foremost, (Estab. 1913)  
Dept. 224, 14th and U Streets, N. W., Washington, D. C.

National Radio Institute,  
Dept. 224, 14th & U Sts., N. W.,  
Washington, D. C.

Send me your Free Book "Wireless The Opportunity of Today." Tell me about your famous Home Study Course in Wireless Telegraphy and Telephony—your Post Graduate Course—membership in the N. R. I. Relay League and your Special Wireless Instruments Offer.

Name .....

Address .....

City..... State .....

### Salaries Up to \$15,000 a Year

Our graduates start work as Senior Operators at \$125 a month, with all living expenses paid. Advancement is rapid to high positions with bigger pay, as follows: Radio Aids, \$6 to \$15 a day; Aerial Mail Service, \$1,500 to \$2,400 a year and 10% bonus; Radio Inspectors, \$1,200 to \$3,500 a year; Radio Engineers, \$2,500 to \$15,000 a year. Our graduates are guaranteed positions upon securing their official license after taking our course. You can learn wireless the National Radio Institute way in a few weeks, by mail, right in your own home. Many of our students secure positions before completing the course, because it is based on actual practice and teaches what is needed to make a big success of wireless work.

### Travel If You Want To

If you want to travel and see the world, go to foreign countries and increase your knowledge of world affairs, wireless offers you the chance of a life time. However, you are not obliged to travel but may secure a permanent position at one of the many land offices, railroads, telegraph or steamship companies near your home, if preferred.

### First Grade License Guaranteed

Our complete course is so thorough and our method of instruction so practical that we are able to guarantee that, after successfully completing our course, you will be able to secure a First Grade Government Operator's License.

"ASK ANYONE WHO HAS USED IT"

## Brandes Wireless Headset

**TRIAL** Buy a Brandes Superior Headset and use it critically for ten days. Then, if it doesn't come up to our claims or your expectations, return it and your money will be cheerfully refunded. Test it—compare with others—for sensitivity, clearness, distance. Prove for yourself the fine quality, the "matched tone." The two diaphragms toned exactly alike, strengthen the signals and prevent blurring. Used by many U. S. Gov't experts and experts abroad; by colleges and technical schools; and by professionals and amateurs everywhere.



"Superior" Set 2000 ohms \$7

Send 4c for Catalogue R

C. BRANDES, Inc., 32 Union Sq., Room 813, New York, U. S. A.  
WIRELESS RECEIVER SPECIALISTS

## Get This Book of Radio Apparatus

EVERY owner of an Amateur Radio Set should have this 64 page book illustrating and describing the newest DeFOREST developments in Radio Apparatus. Contains much valuable information about wiring diagrams, Unit-Type Receiving Sets, individual instruments, complete apparatus with and without cabinets and many other features you will want to know about. Send 10 cents in stamps and get a copy for your Radio Library.

DeForest Radio Telephone and Telegraph Company  
1393 Sedgwick Ave., New York



## BUELL EXPLOSION WHISTLE

### EFFICIENCY

—in your warning signal means safety to life and property. No factor contributes more to personal safety and the elimination of needless repair bills than the Buell Explosion Whistle.

Over 200,000 now in use. Equipment for more than 85 manufacturers. Effective, reliable, durable. Guaranteed for 10 years. In Single Tone or Chime. Buy it from your dealer or write us direct.

**BUELL MFG. CO.**  
Cottage Grove at 30th, - Chicago

## DIAMOND BUYING

10 Months To Pay

### DON'T BUY WITHOUT THIS BOOK

It's filled with solid facts about the values of high grade Diamonds, Watches and Jewelry that will double the purchasing power of your purse.

**Write for the Royal Catalog**

A wholesale jewelry house in a nutshell; goods at prices minus middlemen's profits. Get a copy NOW; it's FREE; learn how to open a charge account and pay monthly or weekly, if you like. Liberty Bonds accepted. Ask for Edition 149.

**ROYAL DIAMOND & WATCH Co.**  
35 Maiden Lane - New York

## "THERE'S MONEY IN IT"

# LEARN TELEGRAPHY

## MORSE AND WIRELESS

### TEACH YOURSELF

in half usual time, at trifling cost, with the wonderful Automatic Transmitter **THE OMNIGRAPH**. Sends unlimited Morse or Continental messages, at any speed, just as an expert operator would. Adopted by U. S. Gov't. and leading Universities, Colleges and Telegraph Schools. 4 styles. Catalog free.

**OMNIGRAPH MFG. CO., Dept. H., 39 Cortlandt St., New York.**



# Mechanical Engineering



## Learn at Home!

Employers everywhere are looking for men with mechanical ability. Splendid salaries and rapid advancement are offered.

There is an easy, delightful way in which you can learn right at home in spare time. For 28 years the International Correspondence Schools have been giving men and women just the training they need for success in mechanical engineering and more than 200 other subjects. Hundreds of thousands have stepped into good positions through I. C. S. help, but never were opportunities so great as now.

Let the I. C. S. help you. Choose the work you like best in the coupon below, then mark and mail it today. This doesn't obligate you in the least and it will bring you information that will start you on a successful career. This is your chance. Don't let it slip by. Mark and mail this coupon now.

### TEAR OUT HERE

#### INTERNATIONAL CORRESPONDENCE SCHOOLS

BOX 7681, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

- |                                                     |                                                                          |
|-----------------------------------------------------|--------------------------------------------------------------------------|
| <input type="checkbox"/> ELECTRICAL ENGINEER        | <input type="checkbox"/> SALESMANSHIP                                    |
| <input type="checkbox"/> Electric Lighting and Rys. | <input type="checkbox"/> ADVERTISING                                     |
| <input type="checkbox"/> Electric Wiring            | <input type="checkbox"/> Window Trimmer                                  |
| <input type="checkbox"/> Telegraph Engineer         | <input type="checkbox"/> Show Card Writer                                |
| <input type="checkbox"/> Telephone Work             | <input type="checkbox"/> Sign Painter                                    |
| <input type="checkbox"/> MECHANICAL ENGINEER        | <input type="checkbox"/> Railroad Trainman                               |
| <input type="checkbox"/> Mechanical Draftsman       | <input type="checkbox"/> ILLUSTRATING                                    |
| <input type="checkbox"/> Machine Shop Practice      | <input type="checkbox"/> Cartooning                                      |
| <input type="checkbox"/> Toolmaker                  | <input type="checkbox"/> BUSINESS MANAGEMENT                             |
| <input type="checkbox"/> Gas Engine Operating       | <input type="checkbox"/> Private Secretary                               |
| <input type="checkbox"/> CIVIL ENGINEER             | <input type="checkbox"/> BOOKKEEPER                                      |
| <input type="checkbox"/> Surveying and Mapping      | <input type="checkbox"/> Stenographer and Typist                         |
| <input type="checkbox"/> MINE FOREMAN or ENG'N      | <input type="checkbox"/> Cert. Pub. Accountant                           |
| <input type="checkbox"/> STATIONARY ENGINEER        | <input type="checkbox"/> TRAFFIC MANAGER                                 |
| <input type="checkbox"/> Marine Engineer            | <input type="checkbox"/> Railway Accountant                              |
| <input type="checkbox"/> Ship Draftsman             | <input type="checkbox"/> Commercial Law                                  |
| <input type="checkbox"/> ARCHITECT                  | <input type="checkbox"/> GOOD ENGLISH                                    |
| <input type="checkbox"/> Contractor and Builder     | <input type="checkbox"/> Teacher                                         |
| <input type="checkbox"/> Architectural Draftsman    | <input type="checkbox"/> Common School Subjects                          |
| <input type="checkbox"/> Concrete Builder           | <input type="checkbox"/> CIVIL SERVICE                                   |
| <input type="checkbox"/> Structural Engineer        | <input type="checkbox"/> Railway Mail Clerk                              |
| <input type="checkbox"/> PLUMBING AND HEATING       | <input type="checkbox"/> AUTOMOBILE OPERATING                            |
| <input type="checkbox"/> Sheet Metal Worker         | <input type="checkbox"/> Auto Repairing                                  |
| <input type="checkbox"/> Textile Overseer or Supt.  | <input type="checkbox"/> Navigation                                      |
| <input type="checkbox"/> CHEMIST                    | <input type="checkbox"/> AGRICULTURE <input type="checkbox"/> Spanish    |
| <input type="checkbox"/> Mathematics                | <input type="checkbox"/> Poultry Raising <input type="checkbox"/> French |
|                                                     | <input type="checkbox"/> Italian                                         |

Name \_\_\_\_\_  
 Present \_\_\_\_\_  
 Occupation \_\_\_\_\_  
 Street \_\_\_\_\_  
 and No. \_\_\_\_\_  
 City \_\_\_\_\_ State \_\_\_\_\_

Canadians may send this coupon to 7-26-40  
 International Correspondence Schools, Montreal, Canada

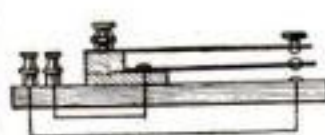
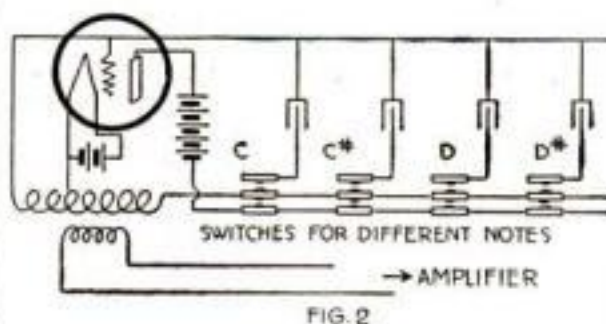
To get the intervening notes of the scale, one reduces the value of LC, which corresponds to middle C, to the fraction shown in the table below:

| Note....                 | C   | D     | E     | F    | G   | A    | B      | C   |
|--------------------------|-----|-------|-------|------|-----|------|--------|-----|
| Vibrations per sec....   | 256 | 288   | 320   | 341  | 384 | 427  | 480    | 512 |
| Fraction of L.C....      | 1/1 | 64/81 | 16/25 | 9/16 | 4/9 | 9/25 | 64/225 | 1/4 |
| Value of product L.C.... | 389 | 307   | 249   | 218  | 173 | 140  | 110    | 97  |

If you want to make a scale containing the usual sharps, namely C sharp, D sharp, F sharp, G sharp, and A sharp, then arrange so that the product of LC is reduced to 89.2 per cent of its value for C sharp, and 89.2 of this new value for D, and so on.

If you do not know the values of your condensers and coils, it is best to "cut and try." Start with a coil of about the right value, and vary the capacity until the musical note that you hear is in tune with some note on the piano or on a violin. Then you can wind up coils or select condensers to give you the other notes, tuning each time to the piano or other musical instrument.

If you are using a relatively large value of inductance, as you should to obtain a good "stiff circuit," you can wind over it quite a large number of turns of fine wire to couple to the amplifier tube. It is well to supply the battery of the amplifier through a choke coil, and to take off the alternating current through a condenser, as shown in the figure. Don't use a tube with too great amplification, in either



Switches connect one tuned circuit at a time and thus different musical notes are formed

This switch closes the tuned circuit and then connects the tube

case, and also be sure that the voltages are adjusted in the amplifier tube, so that you are working on the straight part of its characteristic; for otherwise there will be distortion, and overtones will be introduced.

When you have properly chosen the values of L and C to give the notes you wish, you may arrange a switching scheme like that of Fig. 2. Each switch is a double-contact key like that of Fig. 3. In this circuit you will notice that closing any switch first connects the properly tuned circuit and then closes the plate circuit and allows the tube to oscillate and this produces the corresponding musical sound or note.—TEN BROEKE.

## You Admired Their Health and Strength.

### The Pandicator—

Will give such Health to you.

You watched the soldiers and sailors come home on furloughs and wished—if you were a civilian—that you had the appearance of health—the pep—the vigor of those fighters of ours. Setting up exercises, daily drill and long hikes gave them their health. And this you cannot do—but you can

### Pandicate Your Way to Health

Pandication means stretching and the Pandicator stretches you, giving your cartilages, the pads between the spinal vertebra, room to grow and the nerves emerging from the various cartilages room to carry messages to body organs unhampered.

The Pandicator has made many persons taller, stronger, and straighter and added to their vigor and energy. The Pandicator is the most remarkable health invention of the century. It rejuvenates the human body and gives you the exercise you need, to have health and youthful exuberance. Let us tell you how the Pandicator applies to you. Invented by a College Professor and endorsed by Physicians.

**The Pandicator Company**  
 338 Advance Building  
 Cleveland, Ohio

## HAVE YOU A SAW AND HAMMER?



Then Make Horses and Money

Send 50 cents for this simple cut-out. What you can't sell yourself we guarantee to buy.

**KELBO TOY COMPANY**  
 Cor. 121st St. and Ashland Ave. Richmond Hill, L. I.

**Over 100,000 in Use**  
 Mostly sold through recommendation  
 For Personal Desk or General Office  
 It checks mental calculations  
 Buy through your stationer.  
 Write for 5-day Trial Offer  
 P. E. Gancher, A. A. M. Co.  
 148 Duane St., New York  
 Canadian Agency

**Golden Gem**  
 PORTABLE  
 Adding Machine

Multiplies—Subtracts

Agents wanted

## \$3 A MONTH \$4 WILL BUY

A Beautifully Reconstructed

## TYPEWRITER

With Every Modern Writing Convenience

WRITE TODAY FOR ILLUSTRATED CIRCULAR  
 Explaining Try-Before-You-Buy Plan  
**HARRY A. SMITH, 306-218 North Wells St., Chicago, Ill.**

## TIRES 1/3 LESS

Perfect new tires, all sizes—non-kid, or plain, fabric or cord. Prepaid on approval \$800 to 10,000 Miles Guaranteed

30,000 Customers Catalog Free Agents Wanted  
**Service Auto Equipment Corporation**  
 968 Service Bldg. Kansas City, Mo.

## All the Parts and Plans

75c (no stamps) 1920 Circulet 4c

## HERE BOYS

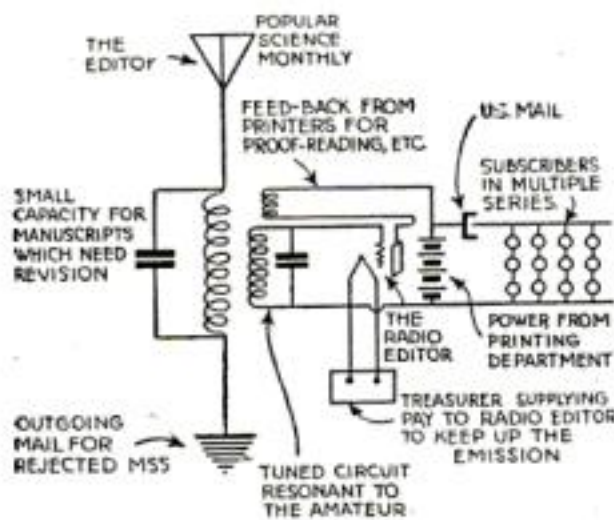
Send 2 cent stamp for information. Other models we make are New York Wasp, Philadelphia Bee, Far Flier, Cloud Clymer, Niagara Moch, Air Bug, and Constructo Outfit. All cloth wings, favorite colors. Address:

**NIFTY NOVELTY & TOY CO.**  
 Mail Order Office  
 NEWARK, N. J.



## A Circuit Layout for a Radio Editor

THE antenna connection leads to the editor of POPULAR SCIENCE Monthly, from whose mail contributions to these columns find their way to his assistant, the radio editor. The latter has a number of turns and con-



This is the picture that our radio Editor drew to show his operation

siderable inductance. The retarding effect is sufficient to prevent anything good getting by him and reaching the other terminal, which connects to the outgoing mail for rejected manuscripts. In his present hook-up a small capacity, formed by a desk drawer, serves to hold contributions that have merit but won't quite do. Some of these he revises. At present it is about ready to break down or to spark over because of a heavy charge of hand-written manuscripts. The compositor objects to these even more than the editor does. If your contribution seems to you worth while, borrow a typewriter and make it look that way.

Coupled with this primary is a circuit sharply tuned to new ideas in radio and resonant with sympathy and interest in the progress of the amateur. There is no "bug trap" or X-stopper, and sometimes the circuit gets a bad jolt. Amateur B sends in a diagram, involving the same principles, but a slightly different hook-up, from the one that the editor has just accepted from amateur A for publication next month. Mr. A gets the check and Mr. B. a rejection slip. There's a damped oscillation of sympathy for the latter. You hope he'll come again.

Then your grid gets blocked with questions from novice X, six at once in lead-pencil on a half sheet of paper and enclosing stamp for immediate reply. X, Jr., wants to know what tube will give the best amplification. Has he read Dr. van der Bijl's articles, which we are featuring? What tube shall we tell him, without seeing his circuit or knowing what he wants to amplify? Then he wants to know what is the limit to the amplification that can be obtained. About here the old tube starts to go bad, or at least to talk that way.

There's a feed-back from the printers, proof-readers, draftsmen, and

## WANT BIG MONEY? Get in the Tire Repair Business

We'll show you how you can have your own business and be assured of big steady streams of profit. There are hundreds and hundreds of men all over the country whom we started out, cleaning up from \$100 all the way to \$1,000 a week. And the demand for tire-repair work is growing at a tremendous pace. This year alone, the U. S. Rubber Company states, the American people will spend \$900,000,000 for tires! We are working day and night to supply vulcanizing and tire repair equipment.

### We Teach You the Business

We have plants and schools located in different sections of the country where we teach you how to operate our complete vulcanizing plant consisting of Section Molds, Retread Molds, Boilers, Tread Peelers, etc., and also all the other details of the General Tire Repair Business.

The United States Government uses Western Tire & Rubber Works methods and machines in the Military Training Schools.

Illustration to right shows how a tire worn down looks after retreading. Our scientific method guarantees 4,000 to 6,000 miles more out of worn tires at one-third their original cost.

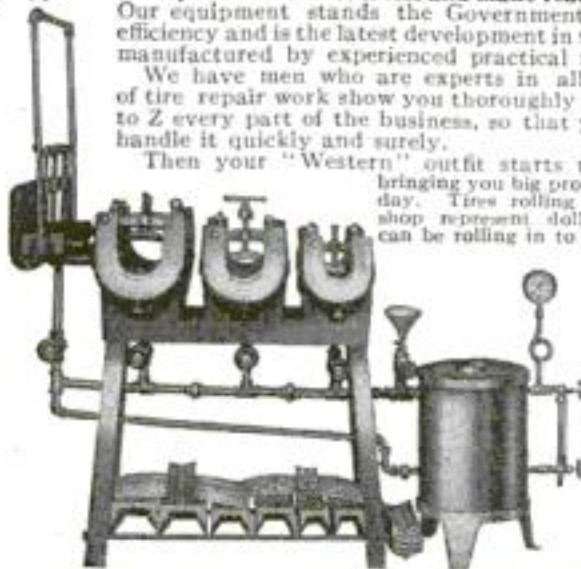
### "Western" Machines Do the Work

For probably half the labor you put in on your present job, you can run your own tire business and make real money.

Our equipment stands the Government test of efficiency and is the latest development in the field, manufactured by experienced practical men.

We have men who are experts in all phases of tire repair work show you thoroughly from A to Z every part of the business, so that you can handle it quickly and surely.

Then your "Western" outfit starts right in bringing you big profits every day. Tires rolling by your shop represent dollars that can be rolling in to you.



### Tremendous Demand

Requests for equipment and instruction are coming in fast and we could do practically our entire business in a few big centers, but we believe it better to have Western shops established in various towns and cities rather than centered.

So we are running this ad to offer the opportunity to you. Write us and we will send you an introductory card to our office nearest your location. We will also send our handsome 1920 catalog showing complete line of the most up-to-date vulcanizing equipment in the world.

Mail a card or use coupon for details of this money making business.

#### WESTERN TIRE & RUBBER WKS.

245 N. Crawford-Ave.,  
Chicago, Illinois.

Gentlemen:

Please send introductory card and free big catalog and other information on Tire Business.

Name.....

Address.....

City.....

Dad and the boys  
off for a day's sport on

## The Johnson Motor Wheel

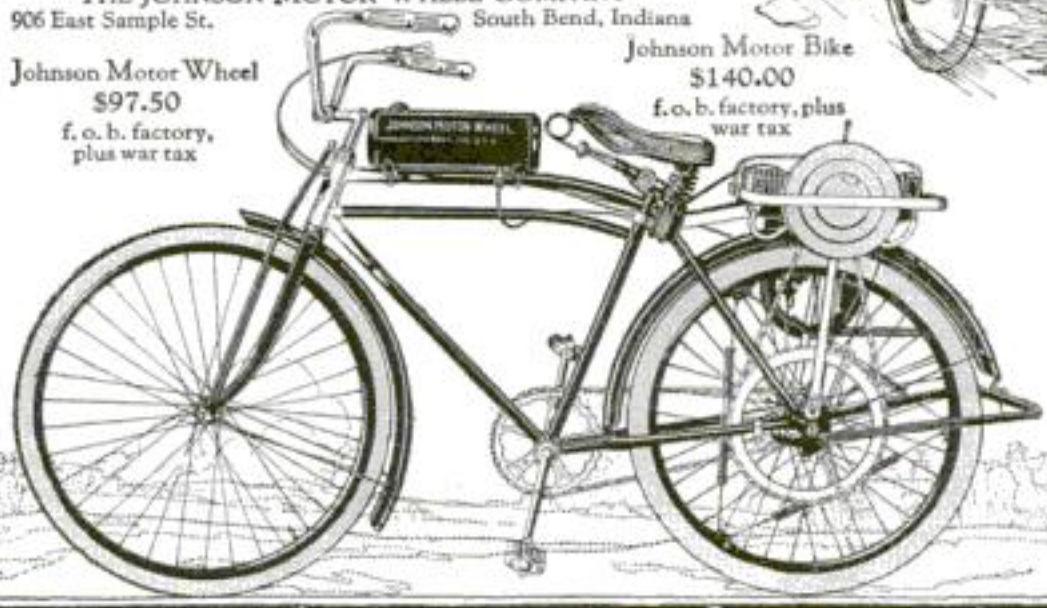
The only two-cylinder motor  
in the world to drive a bicycle

Replace the rear wheel of your bicycle with the Johnson Twin, and you will have a Two-Cylinder Motor Bike. Go 150 miles on a gallon of gasoline or 60 miles for 10 cents, with a speed range of 6 to 35 miles per hour. It consists of flat twin-cylinder motor, extra strong rear wheel with 2-inch motorcycle fabric tire, patented shock absorbing driving sprocket, magneto and electric light generator. Write for booklet.

THE JOHNSON MOTOR WHEEL COMPANY  
906 East Sample St. South Bend, Indiana

Johnson Motor Wheel  
\$97.50  
f. o. b. factory,  
plus war tax

Johnson Motor Bike  
\$140.00  
f. o. b. factory, plus  
war tax







## Leaves tree climbing to the squirrels

There's no steeple-chasing all over the place when your brakes are Garco lined. Even the wildest "flivver" is easily kept in check.

Garco is *always* reliable. It is strong enough to hold anything that runs on rubber—enduring enough to stand the severest strains. Dependable at all times and under all circumstances, is Garco.

N. B. The Garco dealer's is a good shop to "tie up to".

**General Asbestos & Rubber Co.**  
Charleston, S. C.

NEW YORK CHICAGO PITTSBURGH

# GARCO

ASBESTOS  
BRAKE LINING



### The American Gentleman

The "American Gentleman" is a bill-fold you will be proud to own, and proud to show to your friends. Study the pictures and note the 12 useful features. See how neatly they are combined. Note the compactness of the bill-fold when closed. The "American Gentleman" is made of soft, genuine leather in tan or black. Stitched throughout, no edges pasted. Only \$1.50 at any dealer's. Or send \$1.50 with your dealer's name and we will mail you one postpaid.

**Charles K. Cook Company, Inc.**  
Dept. D, Camden, N. J.

Dealers—write for profitable dealer proposition



Makers of Boston Bags, Music Cases,  
Photo Albums, Hand Bags, Suit Cases

## ARMATURE AND MAGNET WINDING

By Horstman & Tousley

A necessary book for electricians. Full facts and diagrams, \$1.75 postpaid.

Popular Science Monthly, 225 W. 39th St., New York

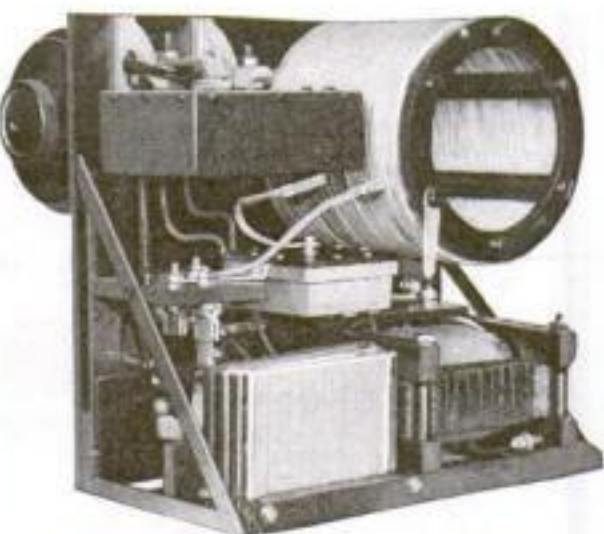
artists, so the circuit is really regenerative. Of course, the tube acts not only as a detector of good stuff, but also as an amplifier; for some contributions need that.

What's our record in words per minute? We don't know, but if your contribution is more than four hundred words, exclusive of photos and sketches, we'll probably beat our record, but we'll use a blue pencil. Don't forget the photographs, and then condense your article into about this number of words, and give some other amateur a chance to get his stuff into the same issue.

## Radio Equipment for Pleasure Craft

EQUIPMENT of small boats and pleasure craft for radio has been made entirely practicable by the development of the transmitter shown in the accompanying photographs. This apparatus has been designed to include all the latest features found in a merchant vessel's equipment, but is so ingeniously constructed that the entire transmitter is contained within a case no larger than a typewriter. The weight has been kept down to a trifle over forty pounds.

The principal value of a set of this character lies in destroying the isolation of cruising waters for the owner who operates his own boat. Designing the set for compactness required the elimination of intricate electrical circuits, and this has been so well accomplished that an inexperienced person can learn its operation after a few hours' practice. Only one adjustment of the transmitter is required, and manipulation of the receiver is equally simple. Thus, after a brief experience with adjustments and about thirty hours' practice at home in learning the telegraph code, the amateur yachtsman is ready to avail himself of the great convenience of having a thoroughly reliable means of communication at hand at all times. With this equipment he may receive the



Rear view of the panel of a new radio transmitter designed for pleasure-craft service

daily storm warnings, news of menaces to navigation, time signals by which to check his chronometer, and may gain lost bearings in fog or storm, communicate with passing vessels, and on



Write for full particulars of our courses.

## THE PALMER SCHOOL OF CHIROPRACTIC

(Chiropractic Fountain Head)

13th and Brady Streets, DAVENPORT, Iowa, U. S. A.

## Music Lessons

UNDER MASTER TEACHERS

# At Home

**A Complete Conservatory Course By Mail** Wonderful home study music lessons under great American and European teachers. Endorsed by Paderewski. Master teachers guide and coach you. Lessons a marvel of simplicity and completeness.

**Any Instrument or Voice** Write telling us course you are interested in—Piano, Harmony, Voice, Public School Music, Violin, Cornet, Mandolin, Guitar, Banjo, or Reed Organ—and we will send our FREE CATALOG covering all instrumental and vocal courses. Send NOW.

UNIVERSITY EXTENSION CONSERVATORY  
6326 Siegel-Myers Bldg. Chicago, Illinois.

## DIAMONDS

### For a Few Cents a Day

Diamond bargains—128 pages of them. The greatest Diamond book ever published sent free for your name and address. Your choice of millions of dollars worth of diamonds sent upon request. No money down. Terms as low as a few cents a day. 5 per cent yearly increase in value guaranteed. Extra 5 per cent bonus may be earned. Write Today for 128-page book, thousands of bargains. No obligations. Write NOW to Dept. 25 J

**J. M. LYON & CO.** 1 Maiden Lane, New York, N. Y.

## Free Book-LAW

Send for this Free 118 Page Book. It tells how you can gain a thorough knowledge of law in your spare time, as 40,000 others are doing. Splendid opportunities in the profession of law. Business today needs law trained men. Free book gives experiences of successful law trained men, and tells how you can read law under guidance of Ex-President Taft and 80 other eminent authorities.

**Blackstone Institute**  
Dept. A125 608 S. Dearborn Street, Chicago

## TELEGRAPHY

### Morse and Wireless

taught thoroughly. Big Salaries. Tremendous Demand. All expenses low; chance to earn part. Largest School in America; established 45 years. Catalog free.

Dodge's Institute, 9th St., Valparaiso, Ind.

## FREE BOOK Learn Piano!

### This Interesting Free Book

shows how you can become a skilled player of piano or organ in your own home, at one quarter usual cost. Dr. Quinn's famous Written Method is endorsed by leading musicians and heads of State Conservatories. Successful 26 years. Play chords at once and complete piece in every key, within 4 lessons. Scientific yet easy to understand. Fully illustrated. For beginners or teachers, old or young. All music free. Diploma granted. Write today for 64-page free book, "How to Study Music".

**M. L. QUINN CONSERVATORY, Studio 2F, Social Union Bldg., Boston, Mass.**

## STAMMER NO MORE

A scientific method that "kills the fear" of stammering. Re-education the key.

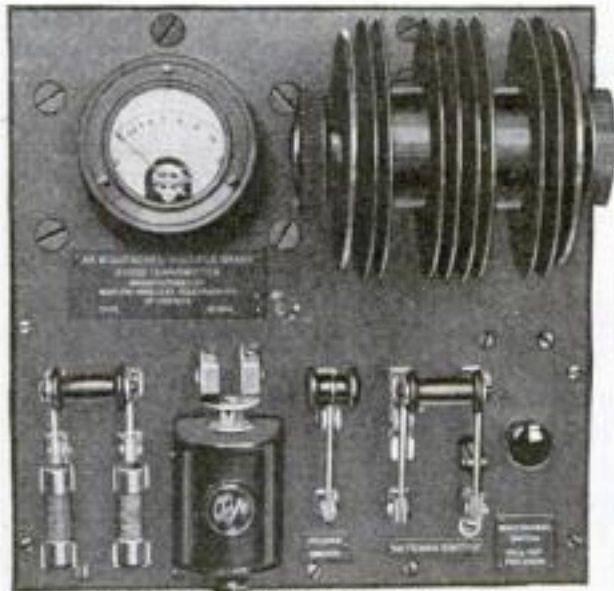
This marvelous method fully outlined in an accurate, dependable, worth while book—"HOW TO STOP STAMMERING" Mailed on receipt of 10 cents.

**The HATFIELD INST., 109 N. Dearborn, CHICAGO**



long cruises receive the news of the day sent out by wireless from shore.

Controls and indicating instruments are mounted on the front of the panel, and the only electrical adjustment to be made in operating the set is the length of the spark-gap. Excepting the flanges of this gap, all parts of the transmitter that carry current are silver-plated, with a satin finish, and carefully lacquered to protect them from tarnishing. A motor-generator is supplied with this equipment, and is



Control panel of a compact radio transmitter that has been designed for use on motor-boats

placed under the operating table. It is the navy type inductor alternator machine, and requires little care and attention.

The receiver is similar in design to those used with such notable success on commercial ships sailing the seven seas. It has a wide range of wavelengths over which signals from many types of stations may be heard, and only a few simple adjustments are required to "listen in" on the ship or shore station desired.

The equipment has sufficient ruggedness to withstand the vibration on small vessels equipped with gas-engines. The complete apparatus may be mounted on a four-foot table instead of spreading it all over the cabin, as was necessary before the present-day perfection of radio equipment was achieved.

### Directing United States Mail Airplanes by Wireless

**A**IRPLANES of the Aerial Mail service may now be directed by radio to the exact spot in the landing field to which they should steer. Experiments of the Bureau of Standards have developed the necessary electrical system.

The airplane carries a loop for detecting the direction of the signals transmitted from the landing field. When the aviator has followed these directing signals to the field, another set of signals reaches him. These come from a special coil transmitter and are of short range. Steering toward them, the pilot lands safely in the middle of the field. These landing signals can be heard from more than 6,000 feet altitude.

# A Home for Her



## and a Business for You!

Both can be had but their achievement rests solely with your ability to recognize your chance and "Act upon it." This is an age of business enterprise. The Vanderpool method offers great opportunities for getting into a business for yourself.

**Hundreds Make \$2000 to \$4000 a Year**

The Vanderpool method makes it easy for you to get into business for yourself. You furnish the "WILL TO DO IT" and with a few weeks of our free course of "HOME STUDY" and our Tire Re-Building outfit, you can be ready to open up a business in a short time. No question of your getting business. Many Tire-Rebuilders are working day and night.

**Think! Men**

37,500,000 Tires wearing out; the Vanderpool method makes it easy for you to learn right at home without interfering with your regular work; it starts you right, teaches you how to use the Vanderpool equipment, opens up vast opportunities for a large and growing business.

**Vanderpool Equipment—A Bear for Work**

Vanderpool five cavity with its greater compactness, convenience and its latest spring improvement has brought us many favorable comments from enthusiastic users. Many are discarding their old equipment and buying this new work producer.

Write for our Booklet immediately; it will get you started right away; it will cost you only a two cent stamp and will easily make thousands of dollars for you.

**The Vanderpool Vulcanizing Co.**  
Springfield, Ohio, U. S. A.

In Answering Address Dept. 7x

After 5 years' experience with most all makes of Vulcanizers, I bought a Vanderpool and went into business. It is compact and convenient, turns out excellent work and a lot of it.  
C. DEER.



## Be A Finger Print Expert

**Earn \$2,500 to \$5,000 a Year**

Learn science of absolute identification, associate with big men, detectives, lawyers, bankers. Solve mystery and crime, travel and see the world.

### Train Yourself in Spare Time

You can do this if you will spend a short time each day in the study of finger print identification. The demand for finger print experts is growing every day and the field is unlimited.

### Most Fascinating Profession in the World

The work is so fascinating and your progress so rapid that you will be delighted to study. It grips you right from the start, puts new life and enthusiasm into you. You want to be looked up to, you want to be recognized as a shrewd man and this is all within your reach. Devote your time and thought to finger print identification. There is nothing in the world that will pay such large dividends in both inspiration and dollars. Get in a profession that's not overcrowded.

### Big Demand For Experts

There are good paying positions waiting for you. The demand for our students is far in excess of supply. If you were ready today to receive our diploma, I would recommend you for one of the waiting positions we now have, paying from \$2,500 to \$5,000 a year, traveling everywhere, staying in good hotels, meeting the best of people and doing a most interesting work.

"Finger Print Facts" FREE. Send for my wonderful book today—its free. It tells you how Hicks' Remarkable System has opened a new earning era for hundreds of men. You can be one of them—simply send coupon for full information. Do it now.

**Federal Finger Print Institute, Inc.**

655 Kemper Building  
Kansas City Missouri

**Federal Finger Print Institute, Inc.,**  
655 Kemper Bldg.,  
Kansas City, Mo.

Without obligation to me, please send your FREE illustrated book "Finger Print Facts" and special offer.

Name \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

Age \_\_\_\_\_ Occupation \_\_\_\_\_



# MAKE YOURSELF A MAN



**STRONGFORT**  
The Perfect Man

100 per cent. in a few short months ANY man who follows its principles. There isn't any doubt of it—I GUARANTEE results. You can't afford to pass up this chance of becoming what you want to be and what your wife wants you to be. Send for my free book "Promotion and Conservation of Health, Strength and Mental Energy." It will tell you how YOU can do what my pupils in every part of the world are doing every day. Send three 2 cent stamps to cover postage and packing and I will mail you a copy at once.

## LIONEL STRONGFORT

Physical and Health Specialist  
1266 Strongfort Institute, Newark, N. J.

Statement of the Ownership, Management, Circulation, etc., required by the Act of Congress of August 24, 1912, of Popular Science Monthly, published monthly at New York, N. Y., for April 1, 1920. State of New York, County of New York, ss. Before me, a notary public, in and for the State and county aforesaid, personally appeared O. B. Capen, who, having been duly sworn according to law, deposes and says that he is the Business Manager of the Popular Science Monthly and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor and business managers are: Publisher, The Modern Publishing Company, Inc., 225 West Thirty-ninth Street, New York, N. Y.; Editor, Waldemar Kaempfert, 225 West Thirty-ninth Street, New York, N. Y.; Managing Editor, Loren Palmer, 225 West Thirty-ninth Street, New York, N. Y.; Business Manager, O. B. Capen, 225 West Thirty-ninth Street, New York, N. Y. 2.—That the owners are: The Popular Science Publishing Company, Inc., 225 West Thirty-ninth Street, New York, N. Y.; Stockholders of Popular Science Publishing Company, Inc., Henry J. Fisher, 22 William Street, New York, N. Y.; Oliver B. Capen, 225 West Thirty-ninth Street, New York, N. Y.; Robert Cade Wilson, 683 Springfield Avenue, Schenectady, N. Y.; Waldemar Kaempfert, 225 West Thirty-ninth Street, New York, N. Y.; George B. Agnew, 22 William Street, New York, N. Y.; Susan D. Elias, 22 William Street, New York, N. Y. 3.—That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent. or more of total amount of bonds, mortgages, or other securities are: Importers and Traders National Bank, 247 Broadway, New York, N. Y.; H. J. Fisher, 22 William Street, New York, N. Y.; Geo. H. Mead Company, Dayton, Ohio. 4.—That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

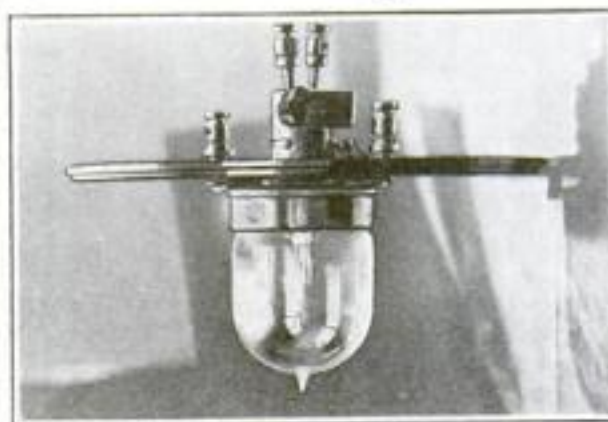
(Signed) O. B. CAPEN, Business Manager.  
Sworn to and subscribed before me this 22nd day of March, 1920.  
Arthur A. Blayvelt, Queen's County—2767, New York County—639, New York Reg. 1612.  
(Seal). My commission expires March 30, 1921.

## STAMMER

If you stammer attend no stammering school till you get my big new FREE book and special rate. Largest and most successful school in the world, curing all forms of defective speech by advanced, natural method. No sing-song, hand-swing or time-beat.  
North-Western School for Stammerers, Inc.  
2335 Grand Avenue Milwaukee, Wis.

## Experimental Vacuum Valve Detectors

SOME years ago the writer designed and described in print a very simple but efficient vacuum-valve detector of the external grid class. It



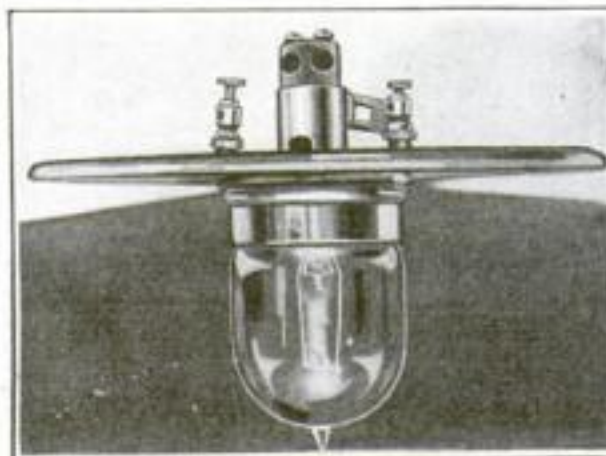
Using an automobile headlight for a valve detector. Tube is mounted on an old phonograph record

was easily made from any one of several of the 6-volt miniature electric-light bulbs of the double filament type which were then in use on certain automobiles.

In the past year several styles of bulbs of this type have been tested. More than seven different types of those on the market to-day are suitable, and very little work is needed to fit them up as detectors.

One of the best and most modern of the above bulbs is the tubular style (maker's number T14). This has two filaments, one consuming .84 amperes, and the other 2.25 amperes. Both filaments are connected outside the bulb and at the base to a common contact. This contact may be found by melting the solder, one of the wires insulated by twisting over it a paper tube and the other soldered back to the contact. The filament connections will then be separate from each other. Of course, only one can be burned without reconnecting the bulb. The other will act as the plate.

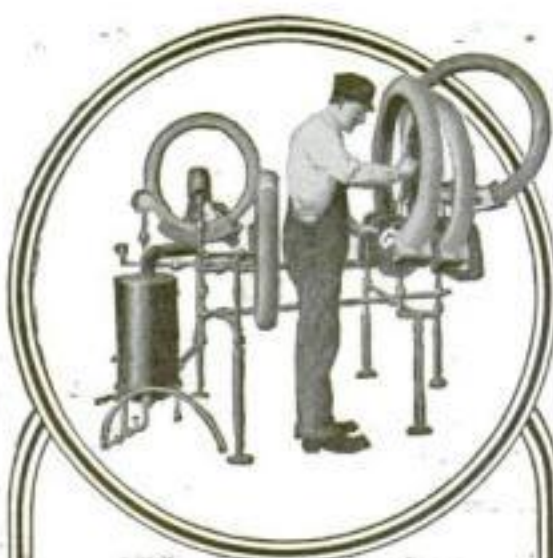
The regular bayonet socket of the tube type may be used, but a binding-post should be soldered to the metal tube part of the socket, to provide for the third contact to the inside of the bulb. This in some cases will be the



Another amateur valve detector using one filament for the plate and the other for the electron emission

plate, and in other bulbs one end of the filament circuit, depending on the kind of bulb used.

An external grid in the form of a cup-shaped base is fitted, and the various parts mounted on a phonograph record base, thus making a neat-looking in-



## Make This Your Business at \$3,000 per Year

Automobile Tire Surgery. There isn't a business you could get into that offers such sure possibilities of **success and fortune**. One man and a Haywood Equipment can make \$250 a month and more. Scores already have done it and this year there is a greater demand than ever for tire repair work.

### "30 Million Tires to Repair"

That's not a myth nor some man's dream. It's an actual fact. The factories everywhere are building new buildings—enlarging their plants for the biggest period of prosperity in the automobile business. 30 million tires will be manufactured and every one will need repairing.

### No Experience Necessary

No previous training, no apprenticeship. We have a complete course, plainly and profusely illustrated, that explains everything. This course is free with each equipment. If you have a little mechanical turn of mind, you can quickly become an expert. You learn in a week. Handle all kinds of jobs—figure prices at big cash profits. Nothing is easier to master completely.



### This is Wm. Oldham

HE EARNED \$2200.00 IN 4 MONTHS with 1 Haywood Machine. Mr. Oldham was telegraph operator for The Illinois Central Ry. 20 years. He is now 58 years old. He just wrote us: "I have earned as much in 4 months as in 24 years as telegraph operator."

INVESTIGATE. Send the coupon below, a letter or postal. This brings full information—and a big interesting catalog. Tells all about tires and how to repair them. Shows how to make money—to become independent. Do this today—NOW—before you forget it.

Haywood Tire & Equipment Company  
1274 Capitol Ave., Indianapolis, Ind.

### FREE CATALOG COUPON

Haywood Tire & Equipment Co.  
1274 Capitol Ave. Indianapolis, Ind.

Gentlemen:—Please send me your catalog, details and plans for starting ambitious men in the Tire Repair business.

Name.....

Address.....

## Don't Wear a Truss

Brooks' Appliance, the modern scientific invention, the wonderful new discovery that relieves rupture, will be sent on trial. No obnoxious springs or pads.



MR. C. E. BROOKS

### Brooks' Rupture Appliance

Has automatic Air Cushions. Binds and draws the broken parts together as you would a broken limb. No salves. No lies. Durable, cheap. Sent on trial to prove it. Protected by U. S. patents. Catalog and measure blanks mailed free. Send name and address today.

BROOKS APPLIANCE CO., 255B State St., Marshall, Mich.



### Learn Navigation by Mail

Hundreds of officers needed by big shipping companies and merchant marine. Captain Warren Sheppard, formerly instructor for U.S. Shipping Board, will tell you how to qualify.

SALARIES UP TO \$412 PER MO. AND EXPENSES  
Write immediately for valuable free booklet, "Your

Future is on the Seven Seas."

WORLD TECHNICAL INSTITUTE  
Dept. 14 Fuller Bldg. Jersey City, N. J.

### CONCRETE ON THE FARM AND IN THE SHOP

This new book illustrates and describes in plain, simple language many of the numerous appliances of concrete within the range of the home worker.

Price, postpaid, \$1.00

BOOK DEPARTMENT, POPULAR SCIENCE MONTHLY  
225 West 39th Street, New York





## Electricians' Knife Scissors and Tweezers

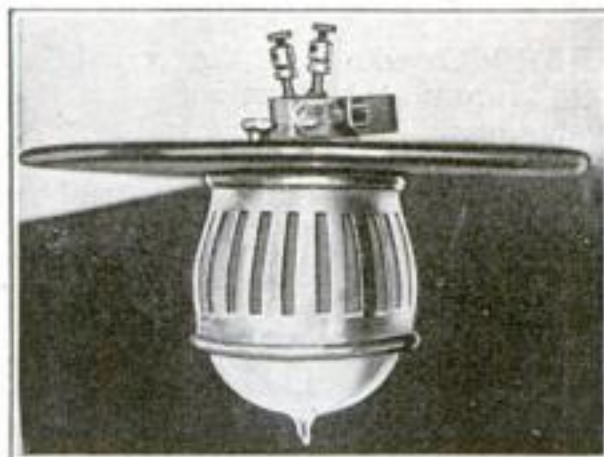
We can meet dealers' demands at once  
and offer attractive quantity prices

Write for description

**MATHIAS KLEIN & SONS, Mfrs.**  
CANAL STA. 3, CHICAGO

strument as seen from the illustration. Most any cuplike piece of metal may be used for the grid. The writer employs two styles, one for a tubular and the other for a round bulb. The former is made from a speaking-tube mouthpiece of nickel-plated brass that just fits the bottom of the bulb. The latter may be a silver-plated mustard-pot guard such as can be bought for twenty-five or fifty cents.

The external grids are connected with binding-posts in the usual manner. The circuit employed with any



In this detector an old silver mustard-pot guard serves for an external grid

of these bulbs is the standard circuit used with external grid detectors.

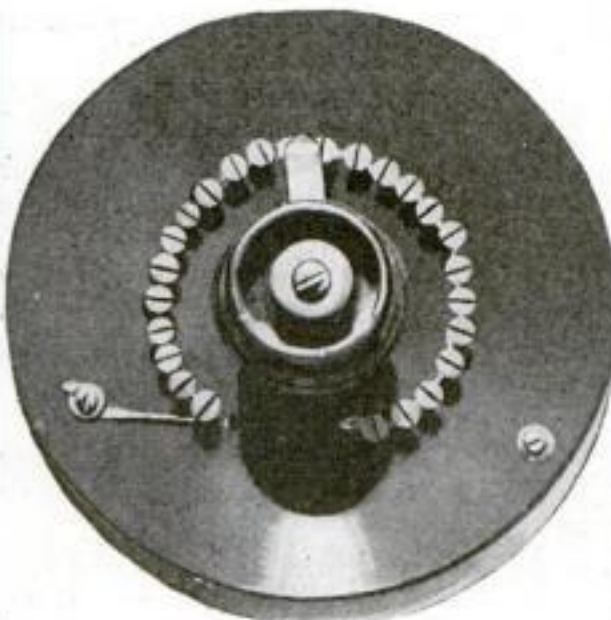
A point to be remembered in using these valves is that the larger the grid employed the smaller the grid condenser must be, since the grid itself is in effect a condenser.

These bulbs, being of the "gas" type, require a critical adjustment, but when this is reached are very sensitive.—R. U. CLARK, 3rd.

## Variable Grid-Leak in a Novel Mounting

THE grid-leak is an instrument as simple as it is useful, but it should be variable for experimental purposes. The simple instrument shown here permits a wide variation of resistance, and may be readily made. The switch is made up from an old record and some screws, as shown.

If a small disk record is used as a base, the contacts should be made of short screws, which can be heated and



This simple grid-leak, permitting a wide variation of resistance, is easily made



## The Micrometer's Story

1867  
1920

## Did You —Ever Know

that away back in 1867 Messrs. J. R. Brown and Sharpe brought from Paris an idea which resulted in what is now the most necessary tool in the mechanical world—the Micrometer Caliper?

That today there are over 100 different types of Micrometers—the result of many years of study and improvement?

This information is told in a most interesting way in our latest booklet, "The Micrometer's Story." After reading it you will understand why

## BROWN & SHARPE Machinists' Tools

are recognized throughout the world as the machinists' favorite.

If you are interested we will send you a copy of the booklet along with our catalog No. 28 which lists over 1000 tools.

**Brown & Sharpe Mfg Co.**  
Providence, R.I.

## Get Our Book Do Your Own Concrete Work

FREE!  
Book  
on  
MIXERS  
Postal  
Gets It

You can make your own concrete feeding floors, water tanks, troughs, and fence posts with idle hands on muddy days and save a lot of money with a

## SHELDON Concrete Mixer

Does work equal to \$300 mixers—yet costs only a fraction. All modern features. Fully guaranteed. Write for catalog now. Sheldon Mfg. Co. Box 4119, Nehawka, Nebraska

## LEARN TO BE AN AUTO and Farm MECHANIC

6 to 8 weeks personal training here will qualify you to earn \$10 to \$12.50 an hour as a trained motor mechanic. Big demand for our graduates.

### MAKE \$150 TO \$500 MONTH

by starting your own garage or repairing your neighbors' autos, trucks and tractors. Here you get personal training on complete equipment—no books used.

Special Rates Now, including Free Tool Kit. Write for full information and 15 day Trial Offer. K.C. AUTO & TRACTOR SCHOOL, Lydia & 15th Street, Dept. 771-A, Kansas City, Mo.



Get a Copy of Our Complete Wireless Catalog and Order All of Your **RADIO MATERIAL** From One Source of Supply and Save Trouble

Send 25c for a copy of Wireless Manual and Catalog A 12

You cannot get satisfaction from wireless instruments unless they are absolutely perfect. The slightest imperfection in construction destroys their efficiency. We offer for sale wireless apparatus only of the highest quality, guaranteed to be mechanically and electrically perfect.

Our combined Manual and Catalog illustrates and accurately describes the uses of standard radio instruments and should be of great assistance, not only to the amateur but to the professional user and experimenter in selecting proper radio material.

WE MAKE A CHARGE OF 25c FOR THIS MANUAL, ISSUING A COUPON REDEEMABLE ON AN ORDER FOR \$5.00 OR MORE. IT IS THE LAST WORD IN WIRELESS CATALOGS. SEND FOR A COPY NOW. YOU CANNOT AFFORD TO BE WITHOUT ONE WHEN YOU WANT TO BUY.

**Manhattan Electrical Supply Company, Inc.**

New York, 17 Park Place  
Chicago, 114 So. Wells St.

St. Louis, 1106 Pine St.  
San Francisco, 604 Mission St.



## Chisel and Punch Auto Kit



**Red Devil**  
MADE IN U.S.A.

About the handiest and most useful little kit the motorist, machinist, or mechanic can possess.

Twelve tools, each 5 inches long, made of octagon stock, Swedish analysis point 80 carbon steel—absolutely the best steel for the purpose.

The kit contains:

- 2 cold chisels
- 2 cape chisels
- 1 half-round cape chisel
- 1 diamond point chisel
- 2 machinist pin punches
- 1 center punch
- 2 solid punches

In your next repair work figure out how frequently you would use this set if you had it. You can get it from your dealer, or send \$3.00 to us direct.

*Booklet of Mechanics' Tools on request*

**SMITH & HEMENWAY CO., Inc.**

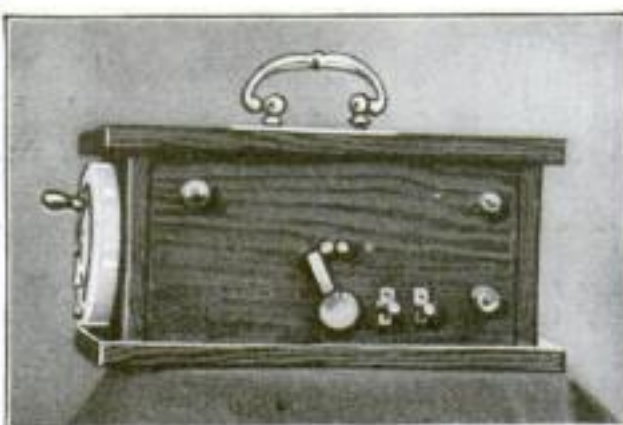
264 Broadway, New York

embedded in the record in such a way that they will not come loose. Each contact is connected with the next by a cotton string, which is soaked in drawing ink several times until the desired range of resistance is obtained.

Suitable binding-posts are fitted, and the necessary contact arm with its knob mounted in the center of the record.—R. U. CLARK, 3rd.

### Making a Vacuum-Tube Control Panel

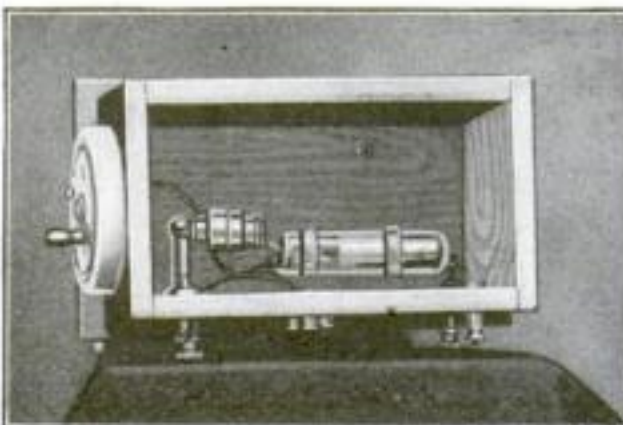
THOSE who are interested in vacuum-tube work realize the value of flexibility in control panels. The panel described is adapted to all



A portable vacuum-tube cabinet with external grid-leak connections

the experiments that may be performed with a tube, and guards it against breakage. It is designed especially for the audiotron, but, with slight changes, may be adapted to any make of bulb.

The completed panel and case are shown above. A case made of 1/2-in. quarter-sawed oak or other suitable dry wood, 9 by 5 by 4 in.,



Shows inside of above portable cabinet with socket adaptable to any style of audion

varnished, will serve. The cover should be hinged, and a small handle may be attached.

The other picture shows the tube mounted in the case, with the filament, grid, and plate leads hooked to their respective binding-posts. Slight variations will have to be made for other makes of tubes than the audiotron. Grid leak and condenser may be hooked in at will.

This panel should prove particularly useful to those who are doing experimental work where frequent changes of connections become necessary.—HARRY W. HANZ.

## Use Your Head

The man who succeeds is the man who uses his head. These practical books will put you on the road to success.

### Means Money to You

The most valuable techno-chemical formulae book published, including over 10,000 selected scientific, chemical, technological and practical recipes and processes is the

### Twentieth Century Book of Recipes, Formulas, and Processes

This book of 800 pages, gives thousands of recipes for the manufacture of valuable articles for everyday use. Hints, helps, practical ideas and secret processes are revealed within its pages. It covers every branch of the useful arts and tells thousands of ways of making money. Cloth-binding. Price, postpaid, \$4.00.

### Getting a Good Job

By Charles R. Barrett

A practical solution of the problem of fitting the right man to the right place, based upon the experience and practice of some of the most successful employers, employment managers and employment agents in the country. It is specially designed to show the employe how to utilize his training and experience to the best advantage when seeking employment or promotion. It explains the basis upon which men are hired or promoted, describes successful methods of going after a job, and gives much practical information regarding advertising for a situation, writing letters of application that bring results, and making a favorable impression in a personal interview. Chapters include such subjects as: "The Right Place," "Training and Experience," "Personality," "Counts," "Salary Expected," "Going After the Job," "Applying by Letter," "Employment Agencies," "Applying in Person," "The First Job," "The Employment Manager" and "Winning Promotion." Your chance of promotion—Capitalize your record—Selling out to a competitor—Trial promotions—Employers pay for efficiency—Get your employer's advice—Lines of promotion. Price, postpaid, \$1.15

### Automobile Repairshop Shortcuts 1500 Kinks

This book contains over 1,500 time and labor saving methods and devices that have proven exceptionally helpful in repairing or adjusting engine clutches, gear-sets, running gears and bodies, etc., and in managing and equipping shops. Mere gimmicks and novelties that have no practical value have been omitted. Every word is simple and to the point; and the whole book is gotten up with the idea of enabling the good mechanic to become a better one by utilizing the experiences of others who may possibly have devised quicker methods of doing the work than he is now using.

Progress comes largely from experience, and here is the opportunity to study the methods of over five thousand experts who were all striving to find a better way to do some job and to shorten the time required to do it.

More than 1,500 illustrations. Cloth binding. Price, postpaid, \$3.50.

### Make Perfumes—Make Money

*Perfumes and Cosmetics, Their Preparation and Manufacture.* By G. W. ASKINSON. A comprehensive treatise, in which there has been nothing omitted that could be of value to the perfumer or manufacturer of toilet preparations. Complete directions for making handkerchief perfumes, smelling-salts, sachets, fumigating pastilles; preparations for the care of the skin, the mouth, the hair, cosmetics, hair dyes and other toilet articles are given, also a detailed description of aromatic substances; their nature, tests of purity, and wholesale manufacture, including a chapter on synthetic products, with formulas for their use. A book of general, as well as professional interest, meeting the wants not only of the druggist and perfume manufacturer, but also of the general public. Nearly 400 pages, illustrated. Price, postpaid, \$5.00.

Book Department

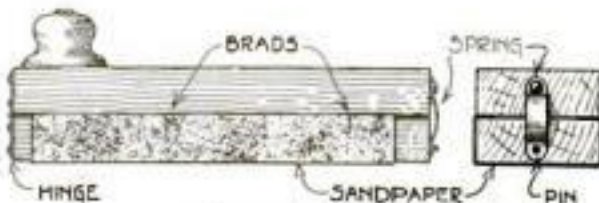
**POPULAR SCIENCE MONTHLY**  
225 West 39th Street New York



## A Simple Sandpaper-Holder for Carpenters

CARPENTERS, and other people whose work involves much smoothing, will find very useful a block such as is shown herewith, which will hold the sandpaper and allow the sheets to be changed.

Two blocks of hard wood of sufficient size are hinged together at one end. Near the hinge on the upper



Just snap the sandpaper beneath this block and you have a holder for sandpapering whenever you have the desire

block is fastened a round knob for a hand-hold. At the opposite end of the blocks is fastened a stiff spring of the shape indicated, with a hole in the lower end which will snap in place over a metal pin in the lower block. This holds the blocks tightly together but they can be separated by unsnapping the spring.

Drive several little brads in the bottom face of the upper block and file off the heads so that they will be pointed.

Place a sheet of sandpaper around the bottom block and bring the ends up, lapping them over the top of it. Then snap the top block down in place and the sharpened brads will be forced through the paper and will assist in holding it firmly in place. When this paper is used up, a new piece can be quickly inserted.—L. B. ROBBINS.

## A Battery-Connector of Sheet Metal

A BATTERY-CONNECTOR made of sheet metal is a necessity where the batteries receive rough usage and the insulation is liable to constant wearing. A connector that can be quickly constructed is here illustrated.



Make your battery connectors of thin copper or brass. They last twice as long as the ordinary kind of connectors

Cut out a piece of thin copper, brass, or tin about  $4\frac{1}{2}$  in. long, and  $\frac{5}{8}$  in. wide. At each end cut slots across the width of the metal and about the shape indicated. Have them on opposite sides. Round the ends and then wrap all the piece except the slotted ends with electric tape.

Several of these connectors in the tool-kit will be found very useful in emergency cases and they will last forever.—WINDSOR CROWELL.



## Ask any carpenter

JUST ask any carpenter who has used one, what he thinks of the Sargent Auto-Set Bench Plane. He will tell you that it's a superior plane in every respect.

## Sargent Framing Squares

SARGENT Steel Framing Squares are the only squares which will calculate the lengths and cuts of Hip, Valley, Jack and Common rafters, without any figuring on the part of the carpenter.

Sargent Framing Squares are made of the finest tool steel and tested for trueness and accuracy. Made in nine dependable finishes. Ask for a Sargent Framing Square No. 500 series.

It cuts fast and cuts true, without any chatter. The cap iron and clamp are fitted together as one piece, with a set-screw to regulate the position. Another set-screw adjusts the cutter.

It may be taken down for whetting in a few seconds and assembled as quickly. Cutter and cap iron go back into exactly the same position as before.

Made in six sizes; smooth or corrugated bottom; fore, jack, smooth or jointer patterns. Descriptive booklet on request.

SARGENT & COMPANY

Hardware Manufacturers

50 Water Street New Haven, Conn.

SARGENT  
LOCKS AND HARDWARE

## A Newly Invented SAW RIG

WILL saw your winter's wood in a few hours and then you can make money sawing for others. Many users say they make upwards of \$11.00 a day cutting wood for neighbors. Expensive cumbersome rigs used in the past are made unnecessary by the Ottawa Saw Rig. Does all practical work any other saw rig can. For a small part of the cost of one of these high-priced and obsolete rigs you can now own the

LOW  
INTRODUCTORY  
OFFER



## OTTAWA SAW RIG

Strictly a one man outfit. Easy to operate, light to move, simple to handle. Powerful 4-cycle motor that drives any belt machinery when not sawing. It will pay for itself in cash in two weeks, just cutting wood for neighbors. 30 Days' Trial; 10 Year Guarantee. Let the Ottawa work a month for you to prove our claims. Write for FREE BOOK TODAY. 372 Main Street, OTTAWA, KANSAS.

OTTAWA MANUFACTURING COMPANY



## The Guiding Hand Needs Production-Figures

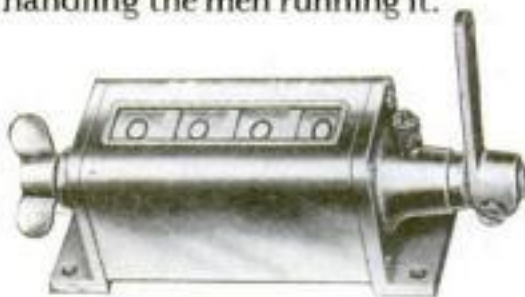
You have to manage a machine—and its operator—with an eye on the *output*, as the only means of knowing how to control the work of each to best advantage.

Any need of mechanical adjustment will show up in the machine's production-record, just as the need of greater incentive will appear in individual totals falling below the *standard*.

You have accurate, timely data in the records of

## Veeder COUNTERS

—putting before you the production-*results* of any method of operating a machine, or of handling the men running it.



The above Revolution Set-Back Counter records the output of any machine where a shaft revolution indicates an operation. Sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price with four figures, as illustrated, \$9.00 (List). Cut less than one half size.



The Number 14 Ratchet Counter at left registers one for each throw of the lever, recording number of machine - operations. Supplied with outside stops which regulate

the throw of the lever, and having return spring action which automatically returns the lever into position for the next count. The lever is adjustable, allowing the counter to be used at any angle. Price, \$2.25. Cut nearly full size.

Most any machine you're interested in can be equipped with a Veeder Counter; the new Veeder booklet shows styles and sizes for all purposes. Copy on request.

**The Veeder Mfg. Co.,**  
44 Sargeant St., Hartford, Conn.

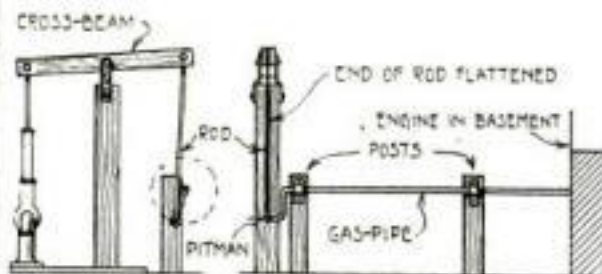
## Baffling the Ingenuity of the "Tool-Borrower"

MANY mechanics make it a practice to mark their tools in some manner for purposes of identification in case they are "lost, strayed, or stolen." This policy is a good one, and the usual procedure of stamping the initials of the owner on the metal with a center-punch, or otherwise recording them in a conspicuous place, is all right so long as the party accidentally or purposely coming into possession of the tools has no evil intentions. However, if the missing article is "borrowed" by one of those individuals never averse to adding to their tool collections at the expense of others, it is simply introduced to an emery-wheel or file, and the evidence of former ownership is lost.

Now, if one takes the trouble to mark his tools at all, why not put the marks where they are least conspicuous, or better still, where they cannot be seen at all unless some part of the tool is first removed? Take, for instance, the usual form of Stillson wrench with the removable wooden handle. It takes but a few moments to remove the nut, slip off the handle, mark the tool, and replace the handle and nut again; and it's just ten to one the other fellow won't think of looking under that handle for identification marks. The handle of a hand-saw can likewise be easily removed and replaced and many other valuable tools offer convenient hiding-places for the owner's initials.—J. A. WEAVER.

## This Obliging Engine Pumps Water at a Distance

ALTHOUGH firmly bolted to its bed in the basement, a small gasoline-engine has been pumping water from a pump in the back yard



No need to have the engine on the scene of operation if you connect it as shown

for two years on a certain southern farm.

The illustration shows how the pump and engine were connected. A hole was drilled through the concrete foundation on a line with the end of the line-shaft already arranged in the basement near the wall. A number of 6 by 6 posts were then set in the ground on a line with the shaft, and extending to a point in line with the pump. The posts were bored with a 2-in. auger. A piece of 2-in. gas-pipe served as a shaft; it was secured to the end of the line-shaft in the basement, and provided with a pitman at the other end. This was then



# I Can Ship Your Engine or Saw Rig

## When You Want It

Save you \$15 to \$500—Cash or Terms—Immediate Shipment—2, 3, 4, 6, 8, 12, 16, 22 or 30 H-P—Stationary, Portable or Saw-Rig—Gasoline or Kerosene. My prices are lowest for High Tension Ignition Engines—the best ignition for kerosene. Easy to start—winter or summer.

## WITTE ENGINES

With BOSCH Magneto

This is the greatest combination of engine and ignition system I have ever been able to offer. Write for latest prices on these outfits—also Drag Log Saw—the most practical for average work—easy to operate—ready to use. Book FREE.

### WITTE ENGINE WORKS

2222 Oakland Avenue, KANSAS CITY, MISSOURI  
2222 Empire Bldg., Pittsburgh, Pa.



## You Can Earn \$250 MONTH with This NEW MACHINE



Make \$3,000 a year and more to start. You need no experience. Open a Tire Repair Shop with Haywood Equipment. Let the money roll in. Business grows fast. You're soon a real manufacturer. Every auto sold means more tires to mend. Demand for your work ahead of supply.

**SEND FOR BIG FREE BOOK**  
This gives all the facts. Tells how to start. How to succeed. A valuable guide to riches and wealth. Write today. A postal will do. Get your FREE copy.

**HAYWOOD TIRE & EQUIPMENT COMPANY**  
1277 Capitol Ave. Indianapolis, Ind.

## Packard

### Wireless Transformers



cover maximum distance with small condensers.

Write for Bulletin P. S. today

The **Packard Electric Company**  
Warren Ohio

Sales offices in all principal cities


## ASBESTOS

We are miners and shippers of Crude Asbestos in any quantity. We produce all grades at our world famous **BELL ASBESTOS MINES**, in Canada. We also card fibres, spin yarns, weave cloths, and make all sorts of Asbestos products.

For anything you want in Asbestos, turn to **KEASBEY & MATTISON CO. ANY**  
Dept. S-4, AMBLER, PENNA., U. S. A.  
Owners of the world's largest Asbestos Mines

## Pilliod

### TOOL CASES EXCEL



Mechanics, Tool Makers and Carpenters find them most satisfactory in construction, appearance, service and price. Immediate shipment.

Booklet describing 20 styles on request.

**The Pilliod Lumber Co.**  
Dept. A, Swanton, Ohio



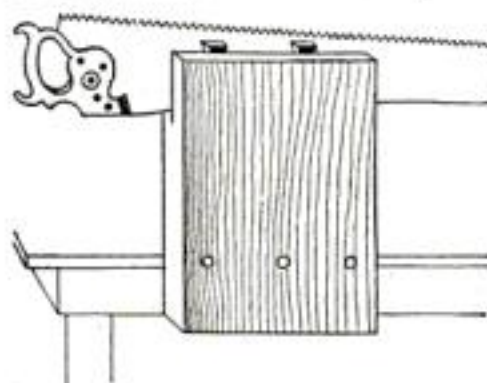
connected with a cross-beam made of a 2 by 6 piece of hard wood long enough to reach from a point over the pitman to the pump shaft; it was connected by a stiff iron rod and strap-irons.

Adjusting the length of the pitman and the bearing in the middle of the cross-arm regulated the stroke of the pump.

It was only necessary to start the engine in the basement, and in a moment water was flowing from the pump to the trough or wherever else it was desired.—DALE VAN HORN.

## To Make a Block of Timber Serve as a Vise

IF no commercial saw-clamp is available when the saw is to be sharpened, a makeshift arrangement is possible. Rip a block of timber open with



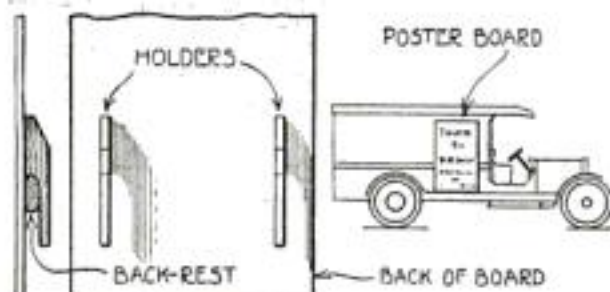
Saw open a plank, insert the saw, clamp with two pegs, and you will have a saw-vise

the saw; insert the saw, back downward into the groove; drive two wooden wedges in to hold the implement securely. The block may be nailed to the end of a work-bench. The saw-clamp—the product of mechanical forethought—is complete.

## Detachable Poster-Boards for Motor-Trucks

ONE enterprising agent for a motion-picture concern advertised recent picture releases by pasting the posters on detachable boards which fitted on the sides of his truck.

Wooden holders, or cleats, were



Why paste posters all over the sides of your truck? Make removable boards and change the posters when necessary

screwed to the back of the poster-board, these being so shaped as to permit their fitting over a board projecting from the side of the body. In this way the boards were set in place and removed at will.

Doesn't this idea suggest a way to increase your business?

## To cut down the cost per cut

### 250% More Work

In power hack sawing, compound acts more as a coolant than as a lubricant. Cutting heats the blade, and the purpose of the compound is to prevent the temper of the blade being drawn.

A few drops of oil or a scanty flow of compound simply tends to hold the chips in the cut and is frequently responsible for broken blades. Whatever you are using for a coolant, compound, or water, see to it that the work is flooded except when cutting iron castings. If you use compound, keep it thin and well agitated. Actual tests have proven that the use of compound will increase the amount of work accomplished by 250 per cent.

Get a copy of the Starrett Hack Saw Chart "W", pick the right blade, put on the weight, see to it your S. P. M. are right—and watch your cutting cost decrease.

### THE L. S. STARRETT CO

The World's Greatest Toolmakers  
Manufacturers of Hack Saws Unexcelled  
ATHOL, MASS.



Use Starrett Hack Saw Blades

use compound.



42

## ELECTRICITY MADE SIMPLE

A book devoid of technicalities. Simple, plain and understandable. \$1.00 Postpaid.

Popular Science Monthly, 225 West 39th St., New York

### \$25 FOR YOU

You can earn \$25 or more a week in your spare time collecting new and renewal subscriptions for Popular Science Monthly. Write to-day.

Popular Science Monthly  
225 West 39th Street, New York

# NEW MOTORS

FACTORY GUARANTEED - ALL SIZES - IN ORIGINAL BOXES

## Your Opportunity

To Buy New Guaranteed Electrical Apparatus of Standard Manufacture.

| Single Phase Motors                                        |          | Charging Generators                                                 |          | Polyphase Motors                                                                  |          | Battery Charging Outlets                                            |         |
|------------------------------------------------------------|----------|---------------------------------------------------------------------|----------|-----------------------------------------------------------------------------------|----------|---------------------------------------------------------------------|---------|
| 110-220 volts, A. C., 60 cycles, 1800 R. P. M. with pulley |          | Suitable for all lighting, Battery Charging and Power Requirements. |          | 2 and 3 phase, A. C., 220 v. 60 c., 1750 R. P. M., complete with base and pulley. |          | To operate on A. C., 60 cycle, 110-220 phase. Voltage as specified. |         |
| 1/4 H. P., 110 volts, induction, full load start -         | \$28.50  | 8 volts, 10 amp. -                                                  | \$19.50  | 1/2 H. P. -                                                                       | \$46.50  | 110-220 v., A.C., 110 watts, 25 v., with switchboard -              | \$68.50 |
| 1/2 H. P., 110-220 volts, induction, full load start -     | \$38.50  | 15 volts, 10 amp. -                                                 | \$24.50  | 1 H. P. -                                                                         | \$64.00  | 110-220 v., A.C., 110 watts, 25 v., with switchboard -              | \$68.50 |
| 1/2 H. P., 110-220 volts, repulsion, for compressor        | \$52.50  | 48 volts, 8 amp. -                                                  | \$31.50  | 2 H. P. -                                                                         | \$81.00  | 110-220 v., A.C., 110 watts, 25 v., with switchboard -              | \$68.50 |
| 1 H. P., 110-220 volts, repulsion, with sliding base -     | \$76.50  | 110 v., 2 1/2 amp. -                                                | \$31.50  | 3 H. P. -                                                                         | \$96.00  | 110-220 v., A.C., 110 watts, 25 v., with switchboard -              | \$68.50 |
| 2 H. P., 110-220 volts, repulsion, sliding base            | \$116.50 | 110 volts, 5 amp. -                                                 | \$46.50  | 5 H. P. -                                                                         | \$112.00 | 110-220 v., A.C., 110 watts, 25 v., with switchboard -              | \$88.50 |
| 3 H. P., 110-220 volts, repulsion, sliding base            | \$142.50 | 48 volts, 30 amp. -                                                 | \$78.50  | 1 H. P., high speed, 3000 R.P.M., 220 v. 3 phase only -                           | \$36.50  | 220 volts, 3 phase, 600 watts, 24 v., without switchboard -         | \$75.00 |
| 5 H. P., 110-220 volts, repulsion, sliding base            | \$184.50 | 110 volts, 10 amp. -                                                | \$106.50 |                                                                                   |          |                                                                     |         |
|                                                            |          | 110 volts, 20 amp. -                                                | \$146.50 |                                                                                   |          |                                                                     |         |
|                                                            |          | Moving Picture Arc Generator 10 v., 35 A.                           | \$106.50 |                                                                                   |          |                                                                     |         |

WRITE FOR CATALOG. BARGAINS IN MOTORS AND GENERATORS

**1/4 SPECIAL**

110 volts A.C., 60 c.

S. P. M., 1750 R.P.M.

Complete, acrt, plug and pulley

**\$22.75**

Each

Reg. Val. \$32.00

**WASHING MACHINE MOTORS**

Suitable for operating all types of Washers, Etc.

**\$22.75**

Each

Reg. Val. \$32.00

**SHIPPING TERMS:** 25% deposit required on all orders. Balance C. O. D. by Express. Sight draft with Bill of Lading attached by freight.

**MANUFACTURERS' DISTRIBUTOR**

**CHAS. H. JOHNSTON, Box 14, West End, Pittsburgh, Pa.**



# SIMONDS KNIVES



## Edgeholding

SIMONDS knives are made of steel containing the finest alloys the world produces—Simonds Steel. They have an *edge-holding* quality which minimizes the necessity for grinding and re-sharpening.

The SIMONDS methods of hardening, tempering, straightening, grinding and balancing are the result of practical knowledge acquired through 88 years' experience.

### Just specify

What kind of knife  
What kind of machine  
What kind of work

**Simonds Manufacturing Co.**  
Fitchburg, Mass.

"The Saw Makers, Established 1832"

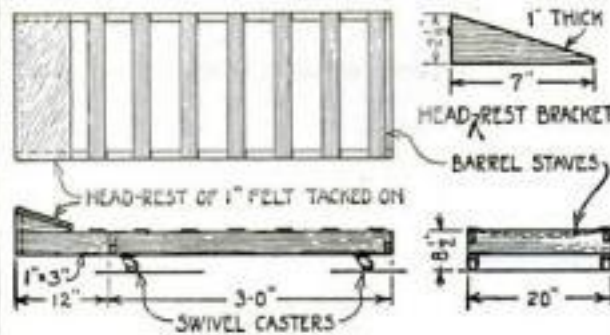
Chicago, Ill.  
New York City  
Portland, Ore.  
Lockport, N. Y.  
New Orleans, La.  
San Francisco, Cal.

Vancouver, B. C.  
London, Eng.  
Montreal, Que.  
Memphis, Tenn.  
Seattle, Wash.  
St. John, N. B.

**SIMONDS** SAW STEEL  
PRODUCTS  
MADE RIGHT SINCE 1832

## When You Get Down and Get Under

WHO of us hasn't spent hours lying on a greasy floor beneath a broken-down automobile? Once was enough for the writer, and so he built the automobile repair creeper



You can't turn the automobile over, so you must lie under it. This creeper protects you from the greasy floor

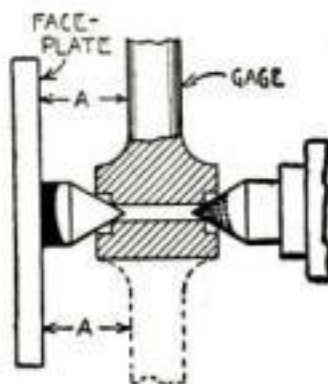
shown in the accompanying diagram. The diagram is self-explanatory and needs no detailed information to describe it.

The creeper provides a convenient method of rolling yourself under the car to be repaired. It is easily and cheaply made. Repairs are more easily made, too, especially where the chassis bolts and nuts or the crankcase have to be removed.—P. P. AVERY.

## Alining the Centers on a Lathe

IF the lathe centers are even a very little out of alinement, accurate work becomes difficult, if not impossible. Nor is it always an easy matter to determine by mere observation whether the alinement is correct or not. The eyes deceive and make the points appear opposite when in reality they are not in line.

A rough, and at the same time a rather delicate gage for testing the alinement may be constructed in the manner shown in the diagram. An iron



If the lathe centers are correctly alined, the distance *A* will not vary as the gage is turned

bar is used, with an enlargement at one end through which a hole is drilled, countersunk at both openings. Into these openings the lathe centers are adjusted, with a pressure about equal to that normally exerted when working.

The conditions are now ready for the test. Simply turn the gage slowly about the axis of the centers and measure the distance from the end of the bar to the face-plate of the lathe. If this distance, *A*, remains constant,

11 01 6 8 2  
13 14 15 16 17 1

## LUFKIN Tapes

STEEL SCALES  
WOOD RULES.  
RELIABLE  
ASK YOUR DEALER  
Send 10¢ for Catalog No. 12

**THE LUFKIN RULE CO.**  
SAGINAW, MICH.

## Big Profits Every Month in Battery Charging

You Can Make \$100 to \$200 Clear Extra Profit Each Month

This HB 500 watt outfit recharges 1 to 8 6-volt batteries at once for 10¢ to 15¢ each. Owner pays 75¢ to \$1.50. Figure those profits. No burn-outs or expensive renewals. No mechanical knowledge required. HB Equipment is absolutely reliable.

Small Cash Payment Puts This HB Outfit in Your Garage

Balance on easy monthly terms. Profits easily carry payments. Small cash investment—easy payments—BIG PROFITS. Absolute Money Back Guarantee. Tear out this ad and mail TODAY for information.

Robert Brothers Company  
Box 561 Troy, Ohio



HB 500 Watt Battery Charger

Does Ten Men's Work

STRICTLY A ONE MAN OUTFIT

## One Man Saws 25 Cords a Day

The Ottawa Log Saw falls trees or cuts off stumps level with ground. Saws up logs, cuts up branches, ice cutter, runs pump jack and other belt machinery. Mounted on wheels. Easy to move anywhere. 10 Year Guarantee. 30 Days Trial. Write for Free Book and Cash or Easy Terms. OTTAWA MFG. CO., 1801 Wood St., Ottawa, Kans.

## Power Benders

THREE NEW MODELS

"COLD" Pipe Bending Machine (pat.) electrically operated to bend from 1 inch to 8 inches. Send for printed matter. We also manufacture T&N other sizes, hand operated to bend from 1-8 to 6 inches.

American Pipe Bending Machine Co.  
Manufacturers—51 Pearl Street, BOSTON, Mass., U. S. A.

## Small Steam Engines and Boilers

Gas and Gasoline Engines, H. P. up; Tanks, Pumps, Gears Model Makers' Supplies

Get Our Big Catalogue sent postpaid for 15¢ (coin preferred) or stamps. Refunded first order. 192 Pages—Over 200 Illustrations.

**MODERN ENGINE & SUPPLY CO.**  
244 Monmouth Block, CHICAGO

## TOOL CASES

for Machinists and Toolmakers

Write for our booklet showing the best built and most practical selection of Tool Cases on the market. We ship direct from factory and guarantee to please you or refund all money.

**H. F. Sauer & Sons**  
50 Columbia St., Dayton, Ohio

## The Midget Slide Rule

will instantly add, subtract, multiply and divide either whole numbers, decimals, fractions or mixed numbers. It solves proportion and gives roots, powers, sines, tangents and logs. The most versatile calculator ever invented. Made of Metal. Size 4". Price with Instruction Book, \$1.50. Satisfaction guaranteed. Send for our Catalogue and Instructions in Logarithms and Trigonometry.

**Gilson Slide Rule Co.**  
Niles, Mich.

## WIRE

electrical, rope, air-plane, piano, pipe-organ, flat, hoops, bale-ties, tacks, nails, barbed-wire, concrete re-inforcement, springs, netting, wire fences, steel posts, trolley-road wires and rail bonds, wire wheels, auto-towing cables, horse-shoes.

**Illustrated Books Describing Uses, FREE**  
**American Steel & Wire Co.** F. Hanke, V.P. & G.S.A. CHICAGO



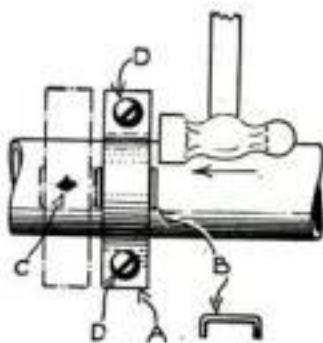
the centers are correctly aligned; if the distance varies, the centers are out of alignment.

So many young men take shop work nowadays that some of them will no doubt be interested in making the test in order to learn what degree of accuracy to expect.—H. C. RIDGELY.

### How to Make a Quick and Lasting Pipe Repair

USUALLY it is at the most awkward moments that accidents occur. It was at such a moment that without warning one of our steam-pipes burst. It was impossible to shut it down at the time, for that would have entailed considerable loss; so our handy man rigged up the scheme shown in the illustration.

He took a two-part clamp, A, and



An emergency repair for a leaky pipe if made this way will last a long time

placed in this a bent piece of thin iron, B. Next to the piece of iron he placed a piece of packing, close to the hole, C, in the pipe. He then drove the complete arrangement on with his hammer and tightened up on the bolts, D. This made a good solid repair until we had time to put in a new piece of pipe.—J. H. MOORE.

### How to Make Quick, Smooth Erasures Without Swearing

IT is a remarkable fact based on wide observation, that about one draftsman in five hundred knows the proper way to make an ink erasure on paper or tracing cloth, though the proper way is absurdly simple. The average draftsman wrestles with his eraser murmuring oaths at himself for making his error. He wonders why he must rub hard and long till his paper or cloth wears thin or tears through; why the erasure is so uneven; why the cloth stretches and leaves a bad-looking spot. It apparently never occurs to him that his drawing-board, covered with thumb-tack perforations, presents a very irregular surface upon which the paper or cloth is unevenly pressed by the erasing operation.

What is required for a successful erasure is a smooth, hard surface to bear upon. A sheet of glass is probably the best expedient but if this is unobtainable every draftsman may at least insert his celluloid triangle under his paper or cloth at the spot where the operation is to be made.—C. NYE.

# GOODELL PRATT

## 1500 GOOD TOOLS



### Universal Caliper Three Tools in One

This useful tool takes the place of an inside caliper, outside caliper, and a depth gauge. You do not have to change tools. You can take either an English or a metric reading as soon as the measurement is made. The jaws may be locked in any desired position by a thumb-screw.

With the Universal Caliper you can make any inside, outside, or depth measurement to 4 inches or 10 centimeters. It is graduated on one side in sixteenths of an inch, and on the other side in millimeters. The jaws can be easily adjusted to compensate for wear. Length over all, 7 1/8 inches.

Price, \$2.50

This useful tool has all the merits which distinguish the 1500 different Goodell-Pratt Tools. Ask your dealer to show you this Universal Caliper, or write us for a complete description of this or any other tool.



GOODELL-PRATT COMPANY *Toolsmiths* Greenfield, Mass., U.S.A.





E. McCarty, Forge Foreman  
38 years' continuous service

## Superior Craftsmanship produces Superior Drop-Forgings

THE old-time smith at his anvil was justly proud of his skill—as proud as a Williams' man of his greater achievements. For it is not modern machines, alone, powerful and efficient tho they be, but true craftsmanship that is responsible for the quality of Williams' Superior Drop-Forgings.

And this highly developed, technical skill is not acquired in a day—it is not a mushroom growth. Tho serving an apprenticeship of years before he is considered to have developed the required standard of expertness as a drop-forging, a craftsman who has worked in Williams' plant for fifteen years is considered a mere youngster to many with records of twenty-five, thirty or even thirty-five years' continuous service.

The personal pride of achievement is theirs,—pride in their skill in every process, in the dexterity that controls the earth-shaking blows of the mighty six ton steam drop-hammers or the buzzing cutters of the little hand milling machines—the skill that, for nearly half a century has maintained the high standard of Williams' product.

### J. H. WILLIAMS & CO.

"The Drop-Forging People"

7 So. Clinton St., Chicago, Ill.

7 Vulcan St., Buffalo, N. Y.

7 Richards St., Brooklyn, N. Y.



**Williams'  
Superior  
Drop-Forged  
Clamps**  
for every purpose

Ask for a free copy of our  
Machinists' Tools Book

## Tapping Small Pieces in a Drill-Press

IN a certain shop where *By John A. Weaver* electrical medical bat-

teries and testing instruments are manufactured, considerable quantities of small brass nuts of varying sizes and threads are used. These nuts are of the punched variety, and the process whereby they are tapped out with rapidity and slight expense is interesting.

The tapping is done in a drill-press, by the aid of a "long tap" with a shank several inches in length, and an easily made jig to guide the nuts under the tap and hold them in position. This jig consists of a rectangular block of cast-iron about 1 in. thick, with one side planed off smooth and square. A hole of the proper size to admit the tap with a little play, is drilled through the block at a point in the center of the width of the block and close to one end of its length. Narrow, flat strips of steel, slightly thicker than the material used for the nuts, are screwed to the face of the block with machine screws in the manner depicted in the illustration. The two short strips adjacent to the hole are spaced so that the nut to be tapped will slide easily through the space between them. When the nut is against the back strip, it should be properly centered, the hole in nut and block being in alignment. The two longer guide-strips fan out to provide a space where a number of the nuts can be placed, so that they can be slid one by one with ease and rapidity into the narrow portion and up against the back strip. The action resembles having the nuts in a hopper and feeding them singly under the tap.

In operation, the cast-iron block is securely clamped to the drill-press table so that the hole in the block is directly under the tap. The spindle of the drill-press is run at a moderate speed, and a quantity of nuts is dumped into the hopper-like space between the guide-strips. With one hand, one nut at a time is slid into position over the hole in the block; with the other hand, the drill-press spindle is operated. After the threaded portion of the tap has passed through the nut, the nut will slide up on the shank of the tap. This will continue until the shank of the tap is full of nuts right up to the jaws of the chuck; then the tap must be removed from the chuck and the tapped nuts stripped off the tap into a waiting receptacle. From 20 to 30 nuts can be tapped before it is necessary to strip this tap,

the number of nuts depending of course on the length of the tap. The threads will not be perfect unless the pressure used in feeding the tap against the work is rather light; usually the weight of the handle operating the feed of the spindle is sufficient. As there is no slow and tedious backing out of the tap after going through a nut, this scheme is a real time-saver. After a little practice, anyone can very easily turn out perfect nuts with considerable speed. It is obvious that the scheme will be effective also for tapping many small pieces other than nuts.



Here is a novel way for tapping small metal pieces in a rapid drill-press

## A Homemade Stand for the Machinist's Tools

A USEFUL stand for holding the small tools and appliances that accumulate in any shop is easily made as here shown. The plan has the advantage that it permits of extension, so that it can be made as large as desired within reasonable limits.

The stand is built around a central support of common pipe and fittings. The only fittings required are short pieces of pipe, or long nipples, and flanges. Have the pipe-fitter run a tap through the flanges, so that the pipe can be screwed in from either side, and have the pipe threaded at both ends. For the bottom section use a short piece of pipe or a long nipple, and screw it into a flange on the flat side. Attach another flange to the first by means of a close nipple, turning the flange so that the flat side faces the opposite way from the first flange.

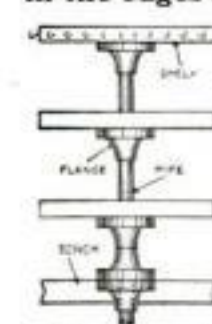
To the second flange fasten a shelf, which may be of any desired shape. Make a hole in the center of the shelf large enough for the pipe to pass through, and screw in a second section of pipe; then put on another flange, another shelf, and so on until there are as many shelves as desired. Put hooks in the edges of the shelves for such tools

as can be hung up; the others may be placed on the shelves. A ledge around the shelves will prevent the tools from sliding off. Flanges may be obtained already drilled for screws.

To support the stand and permit it to revolve, sink a flange in the bench at the point where the stand is to be placed, and ream or file out the threads so

the short piece of pipe at the bottom of the central support will pass through easily, though with no looseness. Be sure to place the bench flange with the flat side up. It will probably be necessary to level the surfaces of the flanges with a file to make them work smoothly together.

The dimensions are arbitrary.



The stand is built around a central support of common pipe and a few fittings



This One



PEYD-RPL-LTE3





# Brunswick

PHONOGRAPHS AND RECORDS



## A great welcome for Brunswick Records

*Music lovers overwhelm us with orders. Tremendous eagerness shown for this latest Brunswick Triumph*

**H**ARDLY had Brunswick records been announced than orders came in from all parts of the country—an avalanche of orders.

We had planned and made preparations for what we considered a very large production.

But the instant approval and the enormous demand compelled us to greatly increase our production facilities.

This reception of Brunswick Records has created a sensation in the phonograph world. No welcome could be more sincere—nothing could prove more certainly the place of the House of Brunswick in the hearts of the people.

## Something different in records

**J**UST as we brought advancements in phonographs when we introduced The Brunswick several years ago, so do we again contribute to better music through improvements in recording.

We come with Brunswick Records at a time when reproduction seems to have reached perfection. But you will quickly appreciate the betterments. We felt 'midst all the wonderful advance of modern recording, that there was still a final development, one that would bring complete synchronization.

The outcome is remarkable. It brings hidden beauty, magnetic personality. It brings life into phonographic music that might otherwise be mechanical.

Pictured here are some of our great artists—famous the world over. Their selections on Brunswick Records set new standards. Hitherto hidden qualities are now brought out sympathetically.

Each Brunswick Record is interpreted by a noted director or an accomplished artist technically trained in the art of recording.

Thus we bring that rare charm into Brunswick renditions which you will recognize instantly.

We invite you to join the thousands of critical music lovers now judging Brunswick Records. Hear them. Make comparisons. Note their superiority.

We're sure you'll want to add many Brunswick selections to your collection of records.

*Remember, Brunswick records can be played on any phonograph with steel or fibre needle.*

THE BRUNSWICK-BALKE-COLLENDER COMPANY  
General Offices: 623-633 S. Wabash Ave., Chicago

Branch Houses in Principal Cities of United States, Mexico and Canada  
Canadian Distributors: Musical Merchandise Sales Co., 819 Yonge St., Toronto



Leopold Godowsky  
Pianist



Dorothy Jardon  
Prima Donna Soprano



Archer Chamberlain  
Tenor



Elias Breeskin  
Violinist



Max Rosen  
Violinist



Irene Pavloska  
Mezzo-Soprano

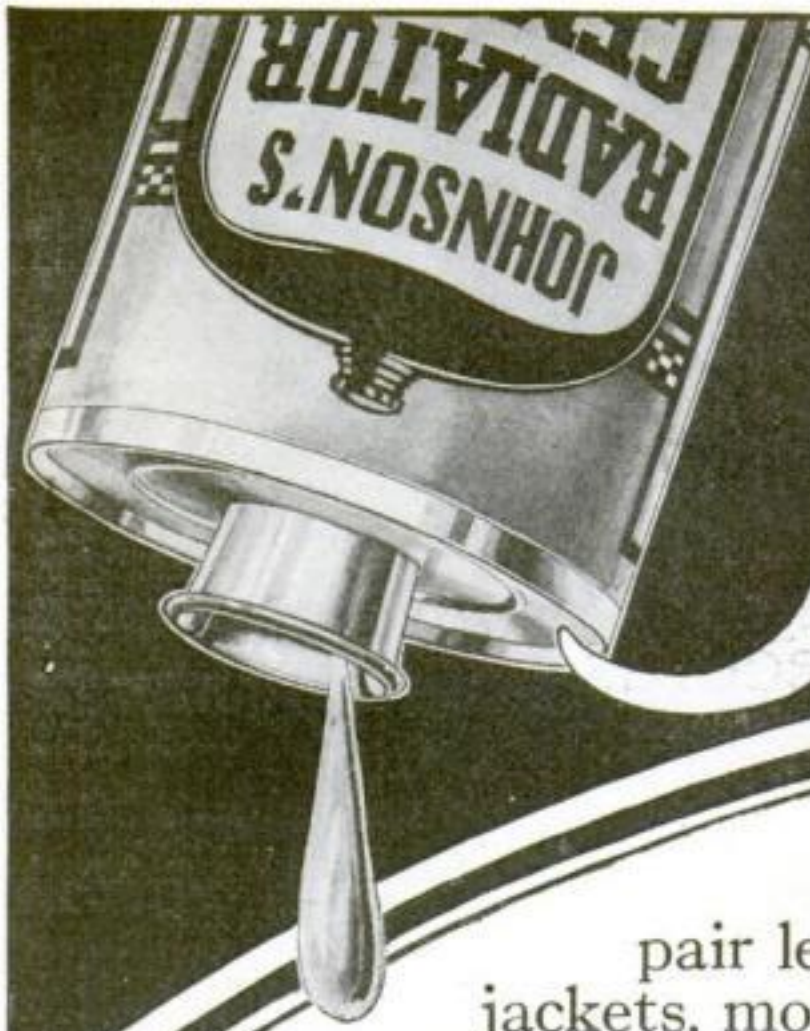


Theo Karle  
Tenor



Virginia Rea  
Coloratura Soprano





# JOHNSON'S RADIATOR CEMENT

**T**HE easiest and quickest way to repair leaks in radiators, pumps, water jackets, motor head gaskets, hose connections, etc., is with Johnson's Radiator Cement. It will stop leaks in from two to ten minutes without laying up the car. It requires no experience to use Johnson's Radiator Cement—all you have to do is to remove the radiator cap and pour the Radiator Cement into the radiator.

## *Quick—Efficient—Harmless*

Johnson's Radiator Cement will not coat or clog the cooling system. It blends perfectly with the water until it reaches the leaks. Just as soon as it comes in contact with the air it forms a hard, tough, pressure resisting substance which is insoluble in water and stops the leak. A half pint is sufficient for a Ford.

## *Keep Your Car Young with Johnson's Car Savers*

Start today to reduce the depreciation of your automobile. An hour or two every month and JOHNSON'S CAR SAVERS will prove their value in dollars and cents when you come to sell or turn in your car.

**Johnson's Carbon Remover**—prevents 80% of engine trouble.

**Johnson's Stop-Squeak Oil**—a wonderful spring lubricant.

**Johnson's Valve Grinding Compound**—gives a velvet seat.

**Johnson's Cleaner and Prepared Wax**—make body, hood and fenders look like new.

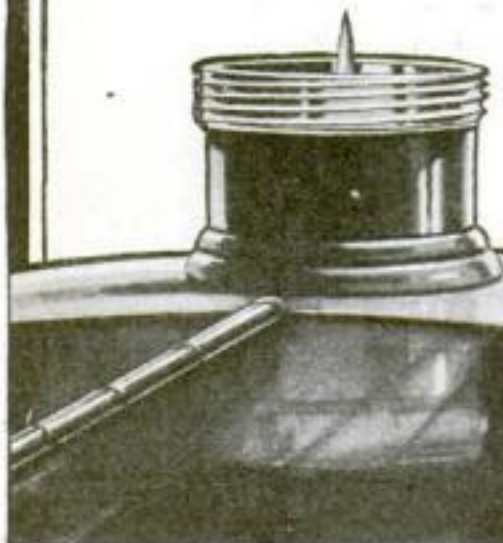
**Johnson's Black-Lac**—the perfect top dressing.

**Johnson's Auto-Lak**—a splendid one coat body varnish.

**Johnson's Hastee Patch**—can be applied in two minutes.

Write for our folder on Keeping Cars Young—it's free.

S. C. JOHNSON & SON  
Racine, Wisconsin  
U. S. A.







URKISH tobacco is the best cigarette tobacco grown on earth. Needless to argue that point—it's the world's verdict.

Like the best of everything; the best Turkish tobaccos are costly.

If the 100% pure Turkish tobaccos of which MURAD is made were cheap in price, there would be but few other kinds of cigarettes smoked.

You can test the aristocracy of a cigarette by the quality and quantity of Turkish it contains—the more Turkish of superior quality used, the better the cigarette.

MURAD is 100% Turkish of the purest and best varieties grown. Could any cigarette be more?

That is why MURAD costs more than ordinary cigarettes. That is why MURAD is Supreme.

*“Judge for yourself—!”*



20¢

*S. Anagiros*

Makers of the Highest Grade Turkish and Egyptian Cigarettes in the World





# GRAFLEX

The camera that does the difficult things  
in photography—and does them well.

EASTMAN KODAK COMPANY, ROCHESTER, N. Y.

*Folmer & Schwing Department*